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ABSTRACT

Nine conference papers focus on the following topics related to the deaf-blind and their education: pitfalls in the coordination of assessment and treatment of handicapped children, promotion of adaptive patterns in the handicapped child, use of hearing in deaf-blind children, etiology of hearing loss, and the educator's assessment of visual functioning. Also discussed are Piaget's stages of cognitive development, the use of Piagetian constructs to study structures of development in children lacking normal cognitive development (the deaf-blind), the application of such a model to educational programing, and the application of the Piaget model to a sequential developmental task curriculum for pre-linguistic deaf-blind children. In the final two papers, implications for the deaf-blind from research on sensory integrative processes in learning disabled children are discussed and the symposium proceedings are synthesized. (KW)

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Proceedings of the
NATIONAL SYMPOSIUM FOR DEAF-BLIND

July 7-10, 1972

Asilomar
Pacific Grove, California

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Division of Special Education
California State Department of Education

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COORDINATION OF ASSESSMENT AND TREATMENT OF HANDICAPPED CHILDREN: PITFALLS
Keynote Address - National Symposium on Deaf-Blind Children
Asilomar, California

Donald R. Calvert, Ph.D.

The human interaction in our attempts to help handicapped children is fraught with pitfalls -- pitfalls which can thwart our best efforts, frustrate our best intentions and obscure our clearest insights. These interaction pitfalls are especially hazardous when we seek to coordinate our efforts in assessing children with our efforts in treating them. We may have the best instruments science can create, the best facilities money can buy and the best staff we can assemble, but unless the people involved in a project can interact effectively, children do not get helped. Many of us have had experiences on diagnostic teams or panels in which we felt communication among professional staff members left much to be desired; in which each member seemed to be talking to himself, justifying his profession, or enhancing his personal-professional image; in which individuals or groups assumed adversary roles, and from which a final summary report emerged which seemed unrelated to the the individual reports and recommendations of the team.

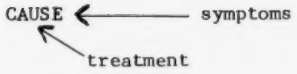
When the Bureau of Education for the Handicapped began implementing the Congressional Act for establishing Centers and Services for Deaf-Blind Children (PL 90-247, Title VI-C ESEA) in 1968, the Bureau staff and its consultants recognized that the need was not only for allocation of more Federal money, but for a better system of providing services. The guidelines especially emphasize periodic evaluations with treatment and educational placement in accordance with these evaluations. The program has left the drawing board and is now well into operation. We are gathered this weekend to discuss how we are doing and how we can do a better job.

I have chosen for this keynote talk to review some pitfalls in the coordination of assessment and treatment of handicapped children, particularly deaf-blind children. By identifying and discussing them, perhaps these pitfalls can be avoided or at least dealt with.

Model Bound

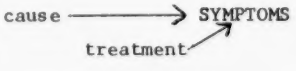
The first pitfall is that of being "model bound." Models present a simplified visual representation of a complex problem. Some models represent structures, others strategies for action. Individuals, groups, institutions, and even whole professions structure their work around models which are either consciously plotted or can be inferred from their practice.

There are three assessment-treatment models which are now popular. The first is the "cause" model in which one assesses symptoms for the purpose of finding the basic cause of a disorder; one applies treatment to the cause once determined. With treatment of the basic cause, symptoms should diminish.



This is the model basic to the medical profession and underlying Freudian psycho-analysis. A correct diagnosis is sought, followed by surgery, medication, therapy, or prosthesis to eradicate or ameliorate the underlying disorder. Treating the symptoms directly is considered futile, inefficient, even quackery. The afflicted are given a label upon diagnosis such as "the rubella child," "a blue baby," or "a brain-damaged child." This model has been valuable for treating physical disorders, somewhat less valuable for treating emotional disorders, and nearly worthless with special education problems. In the process of assessment, an underlying cause for observed symptoms cannot always be found. If a cause can be found, it cannot always be treated. If the underlying cause is treated, the symptoms do not always go away. While the cause is being sought, valuable treatment time is lost and new symptoms may emerge.

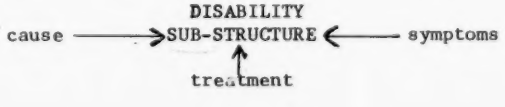
The second model is a "symptom" model. In this structure, the cause is considered of little importance. In assessment, it is important carefully to describe behavioral symptoms, perhaps using a systems analysis approach. Treatment is toward modifying behavior by teaching with appropriate rewards. The goal of treatment is to increase desirable behavior and reduce undesirable behavior. This is the model of the behavior modification psychologist using operant conditioning techniques. It is also the model of numerous remedial "methods" of teaching.



The Cardin method of teaching reading is based on the observation of the symptoms of children who do not learn reading easily. The Moto-Kinesthetic method of teaching speech is based on the observable symptoms of children who do not learn speech easily. To some extent, occupational therapy is based on this symptom model also.

But this model, although very popular now, is also not sufficient to manage all our assessment-treatment problems. When one symptom is treated, the cause may persist and other symptoms emerge. The individual may have modified one kind of unacceptable behavior and develop another in exchange. The treatment may be successful but the patient lost.

The third assessment-treatment model is the "symptom sub-structure" model. In this view, there is hypothesized, between the cause and the observable symptoms, a sub-structure of disability.



Assessment of symptoms is to determine the nature of the sub-structure disability; treatment is applied to the sub-structure disability with the belief that the behavioral symptoms will diminish as these basic disabilities are treated. The child has the abnormal symptom of non-reading. By assessment, it may be determined that he has an impairment of visual perception and/or auditory perception, even though he has no peripheral hearing or vision loss. From such assessment tools as the Frostig Test and the Flowers-Costello Tests, methods of treatment can be derived. Physical therapy is largely based on this model. The Doman-Delacato approach to reading, language, speech, motor and other problems is also based on assumptions about sub-structure disabilities.

This model by itself is also inadequate in that basic underlying causes may persist and behavioral symptoms may not change even though one can demonstrate improvement in sub-structure disability.

The problem with all these models comes when the professional becomes bound to one or another and defends his position by developing rationale after-the-fact. Clashes and misunderstandings between individuals, institutions, and professions result. In assessing and treating deaf-blind children, we cannot afford to be bound by any one of these models. We must be prepared to look at children individually, perhaps treating the cause, the disability sub-structure, and the symptoms all at the same time.

Tool Bound

The second pitfall is that of being "tool bound." Assessment devices, particularly those which offer apparent quantification and sophisticated procedures, are highly seductive to the professional worker.

First, we are likely to assess that which can be quantified and/or computerized. Hence, we may report as progress the number of responses during a given time interval when what we are really after is improvement in the child's general orientation to persons around him. In assessing our programs, we may report the number of pupils seen, the numbers of hours spent, the number of sheets of paper consumed, when what we are really after is the impact on children and their parents in more general ways. We report the child's arithmetic scores, the number of spelling words wrong, and the number of history questions missed, when what we are after are improved study habits and insights. We report the child's response to more or less acoustic pure tones (sounds he never hears outside the test room), when what we really want to know is what understanding he has of speech in a typically noisy classroom situation.

The second problem of being tool bound is that we may teach only that which can be assessed. When assessment tools are sharpened, it is the "sharp" teacher who will alter her classroom procedures to see that her children show progress upon reassessment. This I call the "curse of

accountability." The assessment tools become the curriculum guide.

A third problem of being tool bound is that we may teach only that which can be programmed. Programming typically involves short increments of learning of definable behavior. Those things which can be easily defined, managed in small increments or involve binary choices may become the subject matter taught.

The teacher or therapist may also be limited by the equipment she has available. Placing in any classroom or therapy room a shiny dial and meter infested gadget may direct the teacher away from her intended goals toward those which are associated with the equipment. Not only does the media become the message, it becomes the master -- the curriculum. And, once a program has made a sizable investment in a piece of equipment, it is the administrator's duty to see that the equipment is used frequently, whether or not it is to the betterment of the child. The administrator is responding to his accountability.

Nomenclature

A third pitfall of the assessment-treatment procedure is in nomenclature. There are considerable differences in terminology among the various professions involved in assessment of handicapped children, and an even greater difference separates the assessors from those who provide teaching or treatment. We have yet to realize universal usage of the definitions of "impairment," "disability," and "handicap" as recommended by the Rehabilitation Codes. The direct interchange of staff meetings and panel discussions is severely hindered by esoteric language, the use of initials in referring to places or procedures, and by the allusion to the studies, literature, or experts of special disciplines. Professional reports frequently bear terminology, test results, and other language which is undecipherable to the uninitiated. One man's lucidity is another man's gobbledy-gook.

Part of the nomenclature problem stems from a difference in frame of reference. I recall in 1966 when we were first working with deaf-blind children at the Center, we became vitally interested in what a child could and could not see. Our teaching staff framed a request for information and a child was referred to a local ophthalmologist. The resulting report was a thorough description of the function of the eye. The gap between eye function and visual ability was one that we could not make. I understand that considerable progress has now been made in assessing what young children can see, as well as how the eye functions. Assessment and treatment programs might well spend some time learning to understand each other, learning how to ask the right questions and how to respond with meaningful language. We have a great deal to gain from each other.

Feedback

Another pitfall related to understanding the entire assessment-treatment process is in the

lack of feedback to those who assess. While we are quite familiar with the idea that immediate feedback of results is good for learning with children, we somehow forget this with professional adults. When the audiologist delivers an opinion or makes a recommendation, he has no way of knowing how effective he is in the total assessment-treatment team unless he gets some feedback as to the total diagnostic findings, the course of action to be taken, and the success of that course of action. Either summary staff meetings should be held or summary staff reports should be distributed to all those concerned with the assessment process so that each person gets more than just a narrow picture of the child. That the ophthalmologist's description of the function of the eye was unsatisfactory, needed to be relayed to him by those attempting treatment.

The process of assessment-treatment itself needs evaluation constantly. Each member of the team is an evaluator of sorts. In addition, special evaluations of the process should be conducted by outside persons from time to time with reports to all members of the panel. Not only do we each improve our ability to assess or treat children by such feedback, but we learn about each other's professions and the potential for coordinated effort.

To assure evaluation of the assessment-treatment process, there must be an office or individual responsible for monitoring process. The Federal Act providing for Centers and Services for Deaf-Blind Children requires periodic reevaluation and reassessment of children. With initial intake assessment, the degree of confidence in our results (largely from tests) is very low. The second level of assessment comes with the classroom teacher or therapist working with the child; the confidence in her assessment results are somewhat higher. The third level of reassessment is upon retesting after a period of diagnostic teaching or training. Confidence can be high in this level of assessment only if there is effective circulation of diagnostic information to teacher, therapist, and assessor. All too often the assessors do not receive usable information from the clinic or classroom which would help them in choosing their tests or interpreting their results. Management of the feedback of information in the assessment-treatment of deaf-blind children is an important responsibility of the coordinators of the ten Federal Centers.

Professional Bias

A fifth pitfall, and perhaps one of the most difficult to overcome in the assessment-treatment process, is examiner bias or therapist bias. Partly bound by his accepted model of the process, partly bound by his professional frame of reference, and partly bound by his personal makeup, the professional individual is hard pressed to come to the assessment process as an unbiased observer. Even an analytic computer comes with a ready-made bias given him by those who program him.

One of the most common biases we have to deal with for deaf-blind children is in the

recommendation of long-term placement. Some professionals almost exclusively recommend residential care while others will consider only placement in the home and foster home. Leaning back upon a rock of professional observations, political persuasions, economic understandings, and personal view of the world, some professional observers will not be swayed in their recommendation one way or the other.

A second professional bias is in the involvement of the parents in the treatment process. A few professional workers find parents a nuisance or even a hindrance to the child's progress and thus, may recommend placement of the child outside the home. Other professionals may see the parents of deaf-blind children as being emotionally highly vulnerable and in need of considerable counseling support. While no one can deny that parents do need support, some parents resent being treated like psychotic individuals or children, and would prefer to become involved in direct help for their children. None of us can be entirely free of his biases, but we must recognize that they are involved in our professional interaction.

As we hear papers during the next three days, some of the pitfalls I have described may become manifest. Whether or not we let them interfere with the important work of assessing, treating and teaching deaf-blind children is up to each of us. The pitfalls are part of our challenge as together, we undertake this national program for the welfare of deaf-blind children.

OUT OF ISOLATION AND DESPAIR

Hilde S. Schlesinger, M.D.

Parable

Many, many centuries ago, wise men were to build a near perfect city. The only roads leading to the future city were small and impenetrable, and the terrain beyond them was unknown. No man, not even the wisest of them all, believed that the roads could be travelled, nor that the terrain beyond could contain and support the monuments that mankind deemed desirable in a city. Thus, the Utopia remained unbuilt and the pathways did not become well-travelled roads.

Centuries later, a more intrepid breed of wise men was given the same task. Again, they saw the roads as near impenetrable, although they felt the terrain beyond them to be perfect for a new city. Tools were forged and solutions created. A few wise men were successful. Each created a city to resemble his own home. It was an arduous task and each architect toiled in isolation and despair.

Now that it seemed assured that cities could be built through difficult roads of access, bitter fights ensued about the roads into the city.

The terrain of the future city is the newborn infant. The roads of access and egress are the reciprocal interactions with the environment, and the impenetrable roads represent sensory handicaps. And the wise men are you and I.

****

No parable*, no poetic image, no simple symbol can adequately represent the human brain, even the infant's brain. The first wise men erred and underestimated the ability of humans with sensory handicaps; their successors believed in human potential, but lacked adequate tools on the one hand, and were embroiled in fights to the detriment of the infant and themselves.

Modern History

Helen Keller, a most wise modern woman, stated in her will that the multiply handicapped (deaf-blind) deserve to reach the kingdom of achievement and happiness. Much knowledge has accrued from the old wise men to this modern wise woman. We now know that the normal infant does not lie passively waiting for the adult "architects" to build a city to him, but that almost from birth, he actively searches the environment for sensory and cognitive stimulation. We know now that the sensorily handicapped youngster frequently has normal potential, but that the chasm between potential and the kingdom whereof Helen Keller speaks remains. Those entrusted with the care and growth of the sensorily handicapped youngsters (parents and teachers) are fully aware of the above

*The parable can be found translated into more historical terms with such famous names as Aristotle, Bonet, l'Abee de L'Epee and Heinicke in Levine (1963) and Bender (1970).

mentioned chasm; the refrain of isolation and despair comes not only from the youngsters, but also from those involved with him.

Isolation is an absent, diminished or unsatisfactory contact with the outside world of objects and people. Despair is a pervasive feeling of hopelessness because some of our basic needs are not met and may never be met. Even today, we need to learn more about the terrain -- the infant brain -- how normal developmental stages are affected by a handicap. We continue to learn more about the roads of access and how to maximize their input; how to provide for compensatory input; how to promote and accelerate adaptive behavior; and finally, how to find ways to diminish the divergent patterns that interfere with adaptation, while accepting and encouraging divergent patterns that foster adaptation. Ways to promote adaptive patterns in the handicapped child are elaborated in the following pages.

The Very Young Infant

His needs: There seems to be some consensus on the optimal learning environment for the young infant as one in which the young child is cared for (a) in his own home, (b) in the context of a warm, nurturant emotional relationship, (c) with his mother (or a reasonable facsimile thereof), (d) under conditions of varied sensory and cognitive input (Caldwell, 1967).

The global, macroscopic reactions to the birth or diagnosis of a child with a defect have been described by Ross (1964) and by Schlesinger and Meadow (1972). Temporary or prolonged paralysis of parenting provoked by shock, guilt, and sorrow is an important factor in the ability of parents to provide an environment that is both nurturant and stimulating to the young infant.

The focus of this chapter will be on more microscopic and discrete events in the development of the intact infant as compared to one with a major sensory handicap. Knowledge and appreciation of these differences may contribute to a diminution of parental and professional isolation and despair and a more optimal environment for the young infant and child.

His abilities: The very young infant can see; he can trace an object with his eyes; he has preferences for patterns over colors, and even has preferences among patterns (Fantz, 1967). The very young infant can hear, can localize sound from right to left (but not up and down). The very young infant can distinguish odors (Lipsitt, 1967). Certainly, the very young infant reacts to tactile stimuli.

Despite the fact that these experiments indicate a specificity of perceptual function, there is general agreement that there is a level of cognitive development in infancy in which self and environment are merged (Piaget, 1950). There is some experimental evidence to support the hypothesis that in early infancy there is fusion of oral, tactile, and visual perceptions into an undifferentiated whole (Bender, 1952; Spitz, 1955).

His development: Such an intact infant then proceeds through certain developmental tasks which are important for both cognitive and affective development. For reasons of brevity, as well as paucity of experimental data, only salient tasks which markedly differentiate the average intact from the average deaf or blind infant will be described.

1. The smile: Early maternal attachment and the establishment of interpersonal dialogue. The normally sighted and hearing baby will respond with a selective smile to his mother's voice (Wolff, 1963). A smile in response to a visual stimulus occurs somewhat later, at around six weeks.

Although blind babies smile at the sound of their mother's voice at the same age as sighted babies, they have a marked tendency to smile less frequently and more mutedly (Fraiberg, 1968). There may be a similar delay in the deaf infant (studies of deaf infants are less copious than those of blind infants) and the muted or delayed quality of any baby's smile may be an important factor in some postponement in the establishment of the mother-child dialogue so crucial for later interpersonal relationships. An additional observation may bear out this hypothesis. Following the establishment of a social smile, infants learn to demonstrate affection. The blind infant will be able to do so at the appropriate time only upon maternal request. The actual initiation of affection shows some delay; Fraiberg (1968) postulates that this delay may be the result of the blind infant's inability to note easily the consequence of his actions.

Any delay in social smiling or initiation of affection may be seen by some parents as an active rejection by the infant rather than as a developmental phase. Such a denigrating interpretation of an infant's actions may further compound parent-child difficulties in the area of nurturance and stimulation.

2. Motor development and its influence on learning about objects and people. Blind infants have been described as very quiet babies (Fraiberg, 1968). We have found deaf babies frequently so described by their parents (Schlesinger and Meadow, 1972). Quiet babies lying passively in their cribs may either provoke the mother to frantic overstimulation or to massive understimulation. The amount of cognitive input will not be optimal in either case. Furthermore, the necessary nurturant emotional relationship may be negatively affected either by a hectic, overstimulating mother or by one who barely notices the infant. Despite the above important variables in early motility, Fraiberg (1968) indicates that the study of gross motor development in the blind infant during the first eight or nine months follows maturational patterns and a timetable that closely parallels those of the sighted child. The elevation of the head in a prone position, rolling over, sitting independently, appear without significant delay. These motor achievements are relatively independent of vision (p. 279). An important difference and

exception occurs around the fifth month: sighted babies having discovered their hands, will playfully and purposefully begin to bring the hands into the midline of the body (or into their visual field); at the same time, they are able to obtain an object on sight. Fraiberg again notes that blind infants do not bring their hands into the midline without help and do not reach for an object. "There is no adaptive substitute of sound for vision at this age" (Fraiberg, 1968: 281). The normal and the blind infant are both able to be in an about-to-creep position, but only the sighted infant is propelled forward at this early age as he is trying to reach for some desired object; the blind infant will remain stationary with some rocking movements. It was even noted that blind babies whose parents had received some developmental counseling reached for an object by sound only from one to six months later (from six to eleven months). Only when this reaching for an object occurred did the blind infant also propel himself forward with a creeping movement. In an intact infant, during the second and third quarter of the first year of life, the fusion between oral, tactile, and visual perceptions diminished, and the hands achieved a gradual independence from the mouth and were more under the influence of the eye, an intermediary between eye and mouth, and a tool to control the outer world (Hoffer, 1949). Fraiberg (1968) has noted that the blind baby traverses a long and difficult route in order for the hand to locate objects and to serve as the vital bridge between the self and the outer world (p. 284). Some blind children never achieve this hand autonomy and continue to use their mouths to explore the environment, whereas some others regress to a use of the mouth rather than the hands at times of stress.

The hand of the sighted infant which reaches for an object in the visual field at age five months can institute a search for an object no longer in the visual field between sixteen and eighteen months. By this age, most youngsters believe in the continued existence of an object which is no longer in their field of perception. This is known as permanence, and blind youngsters show about a year's delay in the acquisition of this task. This delay in knowing that objects continue to exist when outside the immediate perceptual field, is accompanied by greater intolerance for maternal absences, an intolerance that frequently results in panic. "Compared to the sighted child, the blind baby lives in a sensory void; objects emerge from the void and make accidental contact with his hands or the hands in random movements make accidental contact with objects" (Fraiberg, 1968: 284).

Blind youngsters continue to show decreased motility when they perceive a danger to themselves from the environment (objects not seen may be in the way) or from some person. Sighted children will express outward-bound aggression, but without vision, the blind child cannot assess hostile acts accurately.

3. Language development. Most of the divergent patterns above have referred to blind children. The inpact of deafness on the varying developmental tasks has been described elsewhere (Schlesinger and Meadow, 1972). The most important divergent pattern for deaf infants and children lies in the area of language (competence and performance) and speech.

Lenneberg, Rebelsky, and Nichols (1965) indicate that crying and cooing are regulated by physical maturation and initially, at least, are not contingent upon specific acoustic stimuli. Thus, deaf children are usually described as developing normal patterns of vocalizations until about six to nine months of age. At nine months, a decrease of vocalization is noted in the absence of corrective hearing aids.

There is very little literature on the language achievement of deaf children between the ages of nine months and six to seven years. Clinical and anecdotal material, however, clearly reveals that these children are showing the beginnings of the cumulative deficit in language that is invariably reported among deaf school children and adults. The findings comparing Mecham scores of the deaf and hearing subjects in our study of deaf preschoolers can be seen in the following table:

Mecham Scores of Deaf and Hearing Children

Numbers and Percentages

Language Age in Months (Quartiles)	Deaf		Hearing	
	%	(N)	%	(N)
5 - 16	35	(14)	--	(0)
17 - 28	40	(16)	--	(0)
29 - 52	23	(9)	25	(5)
54 - 69	3	(1)	75	(15)
Total	101	(40)	100	(20)

Studies of school age deaf children uniformly suggest that the underlying area in which a deaf child is weakest is in language ability (Moores, 1970). On academic achievement tests, deaf children score lowest on word meaning and paragraph meaning subtests. Furth (1966) indicates that only 12 per cent of deaf adults achieve true linguistic competence and only 4 per cent are proficient speech readers or speakers. In summary, by the time they have reached adulthood, most deaf adults have not mastered the shape, sound, and sense of the primary language of America -- oral English.

Maximizing the Potential of the Sensory Handicapped Child

Schlesinger and Meadow (1972) have postulated that the impact of deafness on the developmental tasks is both a result of the deficit itself and of the reaction of others to it. Fraiberg

(1968: 266) has paraphrased the view of other workers on childhood blindness (Burlington and Chess) in the following way:

> As our own research progressed, we were able to link certain developmental roadblocks with a clinical picture seen in the older blind child. Very briefly, we now know that not blindness alone but tactile auditory insufficiency in the early months will prevent the blind baby from making the vital attachments to his mother and to the human world. We must insure adequacy in this area through our work with parents. We now know that the adaptive hand behavior follows a very different pattern in the blind infant and the hands must be educated in special ways. We know that certain gross motor achievements are impeded by the absence of vision and we know how to facilitate these achievements. We know that the blind baby remains helpless and defenseless before the most ordinary dangers of early childhood and we can introduce prophylactic and remedial measures which build adaptive capacity. In short, we have studied the unique adaptive problems of the blind infant in our research and translated these findings into educational measures for the blind baby.

I should like to subdivide these "prophylactic and remedial" measures in the following way:

1. Maximizing the remaining abilities of the sense organs. Maximizing residual hearing and vision entails early, accurate diagnosis with appropriate intervention. Early, accurate diagnosis, although possible, is not yet universal. False and delayed diagnoses or prognoses continue to occur (see Schlesinger, 1971). Appropriate intervention entails occasional chemical treatment and surgical procedures such as cataract surgery or elimination of superimposed conductive hearing losses. More frequently, however, it entails the early usage of adequate hearing aids with appropriate auditory training. Again, this is feasible, but not nearly universal enough. An audiological diagnosis does not miraculously produce the perfect hearing aid for any particular infant. In our present research, we find wide variability in attempts to place the most appropriate hearing aid on each youngster. Some youngsters are fortunate to have patient audiologists who experiment with loaners for prolonged periods of time. Other children, however, receive only one chance and the parental pocketbook may not be able to afford a necessary retest and change during the life span of the hearing aid. Some children are fortunate enough to have contact with teachers who test the hearing aid daily, whereas others go for long periods of time with non-functioning aids, or do without while repairs are being made. Some youngsters are fortunate enough to have parents with sufficient emotional acceptance of the deficit to enable them to help their child wear an extrinsic device, whereas others pay lip service to the need for a hearing aid, but feel

ambivalent about its use and interfere with the child's ability to profit optimally from it.

Some of our youngsters are fortunate enought to have a "U-shaped hearing loss" and thus, are more likely to benefit greatly from the hearing aid, whereas others have a rapidly descending slope, which means that the benefit will be less. At all times, while maximizing the functioning of the sensory organ, it behooves us to watch for clues from the child. Diagnosis is not always easy and we have occasionally seen youngsters initially diagnosed as deaf, fitted with hearing aids too powerful for their minimal or nonexistent hearing loss. We have also seen a "deaf-blind" youngster whose auditory diagnosis read "should be able to use hearing well," and whose ophthalmologic diagnosis read "has no functional vision left." This particular youngster used his vision for reading (with hose nose smudged with newsprint), but was unable to use his hearing even with an aid.*

2. Providing compensatory input. Burlingham and Fraiberg repeatedly emphasize that additional tactile and auditory stimulation of the blind child can diminish the retardation in object and person relationship so frequently noted as a developmental roadblock. However, Burlingham suggests (1964: 107) that mothers not be urged to be active with their children, but to teach them instead to look for clues that betray the child's need for activity. For, if understimulation produces inhibited motility, overstimulation can produce tuning out. White and Held (1966) have found that there is an optimum time for different kinds and intensities of interaction with the environment. An interesting suggestion for providing compensatory proprioceptive input comes from descriptions of Nigerian culture that values proprioceptive clues more than visual ones (Wober, 1967). If I remember correctly, some African Olympic runners recently shown on TV were able to run over uneven terrain without visual check, possibly because of some optimally developed proprioceptive input and analysis. If this is true, the blind infant might also benefit from such input and analysis, and professionals could gain crucial knowledge.

The child with a hearing handicap, which appears at least partially irreversible even with the most sophisticated hearing aids, will also need compensatory visual input, whereas intact children may not need but certainly benefit from input across different modalities. The necessity, amount and type of visual compensatory input for the deaf child varies with different professionals: Some play down the actual necessity, others add lipreading, and still others encourage the use of combined sign and spoken word input.

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*It would appear that similar questions continue to exist about the visual hardware for the visually impaired child.

3. Promoting and accelerating adaptive behavior. We have previously indicated that the blind infant inhibits motility. Burlingham (1965: 196) indicates that it is not difficult to demonstrate that both the motor impulses and the potential pleasure in motor discharge are present but are, in fact, rendered ineffective by the child's own control. As soon as conditions of absolute safety are provided, the blind child too will eagerly hop, jump on a trampoline, run and dance when held by the teacher's hand, or even ride a bicycle in a cleared area. The child will gladly "let go" of his own controls as soon as he is fully confident that danger arising from motility is controlled by the environment.

The "simple" act of bringing hands together in the midline so that they learn to hold and manipulate objects and thus gain rudimentary control over the environment becomes a Herculean task for the blind infant when no special intervention from the outside is forthcoming. However, Fraiberg (1968) indicates that such a midline position can be achieved through a number of strategies that facilitate mutuality, reciprocity, and coordinate use of the hands. Pattycake games and other games that insure pleasurable contact of the hands at the midline, presentation of toys and other interesting objects in the midline are to be encouraged.*

These two strategies in promoting and accelerating adaptive behavior can help the blind child and his caretakers toward optimizing cognitive and affective development.

Some potentially exciting strategies are being developed for the deaf infant in order to enable him to develop one aspect of adaptive behavior. As is well known, the vocalizations of deaf infants are initially normal in quantity and quality. However, a decrease in vocalizations is usually noted somewhere between the sixth and ninth month of life in the absence of corrective hearing aids. Rheingold, et al (1959) have demonstrated that the vocal behavior of 3-month-old intact children can be increased by reinforcement that need not be auditory in modality. The infant will similarly respond with increased vocalizations to visual stimuli (smiling) and to kinesthetic tactile stimuli.

Dr. Leo Connor (personal communication) has indicated that the Infant Center at the Lexington School for the Deaf is presently experimenting "with two classes of electronic devices: (a) those which encourage, reinforce or train vocalizations and productive language, and (b) those which reinforce or train listening and receptive language." The first of these may be classified under this rubric, whereas the second may more genuinely belong in the rubric of maximizing the function

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*Some "blind" infants have reduced central vision, but rudimentary peripheral vision. It might be that these infants need help to bring their hands together at the locus of their best vision.

of the sense organs. The reinforcers for the child's vocalizations include both visual and tactile (voice-activated mobile), and kinesthetic (voice-activated crad[illegible] rocking the infant).

4. Diminishing the differences which interfere with ada[illegible]on, but accepting, even encouraging, those divergent patterns which foster adaptation. Eac[illegible]an being is unique and is consequently different from any other in a multitude of ways. Many clinicians such as Erich Fromm (1939), Karen Horney (1937), Carl Rogers (1951), and Harry Stack Sullivan (1953), have emphasized the intimate connection between acceptance of self and acceptance of others. A genuine acceptance of self presupposes an acceptance of all or most characteristics such as sex, age, looks, and performance level.

The growth of self-acceptance is accompanied by early awareness of human differences. Ideally, human differences can be accepted either joyfully or neutrally. Realistically, however, many human differences in terms of age, sex, color, performance, etc., are unequally valued in the world of the child. The child growing up will learn without being "taught" which human attributes are considered valuable in his environment. Lucky is the child who senses that his or her particular attributes are considered valuable or acceptable in his environment -- not only will he grow in his own self-esteem but also, he will be more likely to accept others who differ from him. Such acceptance o[illegible] self and others varies widely and is not an immutable phenomenon. At times of stress and crisis, even the most adjusted person may question his own value and may not accept himself, nor accept others who differ from him.

The above phenomenon may be one of the most crucial and relatively unstudied areas in the development of the child with a handicap. We have noted that parents attempt to force their child into a normalcy not available to him. Chess, et al (1971) and Burlingham (1964, 1965) note throughout their articles that there is excessive and ineffective energy used in suppressing unimportant differences.

I should like to suggest that in helping each child to achieve his maximum potential, we study more carefully which differences may be useless or even harmful to him, and which differences are actually promoting adaptation. For example, Burlingham (1964) notes that the typical "attentive" response of the blind child to acoustic stimuli is that of lying motionless as compared to the normally sighted child who will turn his head and eyes in the direction of the sound. This maneuver undoubtedly, helps the child to localize the sound with his intact sense. Mothers, however, are frequently reported as being disappointed by this reaction because it is contrary to their expectation and because it uses a sense organ in a way not within their usual repertoire.

Hearing aids and glasses are extrinsic devices which make the child visibly more different but which certainly promote adaptation by increasing cognitive input. Nevertheless, many parents

unconsciously resist this adaptive difference.

Our own work (Schlesinger and Meadow, 1972) tends to corroborate the impression that attempts to eliminate sign language may represent an aspect of the ineffectual "forcing into normalcy." Indeed, we feel that sign language is generally helpful in the development of deaf children when it is used with positive affect, without conflict, is accompanied by speech and auditory training, and is used early before a feeling of communicative impotence occurs between parent and child.

On the other hand, there are divergent patterns which are useless or potentially harmful to the developing child. The inability of the blind child to place his hands in the midline without outside help has been described above. The deaf child will frequently use unpleasant sounds in an attempt to gain attention; parents fear inhibiting inappropriate sounds because of their hope that appropriate sounds and words will take their place. In our experience, inappropriate vocalizations can be eliminated without affecting the desired speech acquisition.

Finally, there are some divergent patterns that necessitate further study. For example, blind children frequently hold their heads in a lowered position and are frequently forcibly and physically "reminded" to hold their heads up. Some workers with the blind have suggested that light coming to a more sensitive eye causes this postural tendency and that tinted glasses are helpful in eliminating this divergence. On the other hand, it may be that the blind child is trying to develop proprioceptive clues to the whereabouts of his body in space. More research is needed in this area.

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To return to the parable -- In many ways, the modern wise men are wiser: They know that the city can be built; they know that the roads can be improved with new tools; they know that additional roads will facilitate access; they know that the terrain itself must be taken into account. In some ways, they are not yet wise enough: They continue to think that theirs is the only way to build a city; they isolate themselves from others with different plans instead of sharing ideas. But they are growing wiser; there is less isolation and despair and more cause to hope for the future of the architects and the cities.

Some Developmental Differences in Intact, Deaf, and Blind Children

Age	Deaf	Intact	Blind
4 weeks	?	Beatific smile at mother's voice	*Muted smile at mother's voice
6 weeks	idem.....	Smile at mother's face	*Absent reaction
5 months		"hands in midline" reach and obtain object on sight	*No adaptive substitution of sound for vision at this age (Fraiberg, 1968: 281)
6 months	idem.....	mobile, creeps or crawls; normal depth perception	Delay (see below)
	Decreasing vocalizations.....	Increasing vocalizations.....	idem
6-11 months	*.....		Object reached for on sound
2nd year	*Delayed language development	"Normal" language development	idem (Lenneberg, et al, 1965)
	idem.....	Permanence established; object must exist somewhere even if it cannot be perceived	*Permanence not established, will search for object only where last heard
		This object permanence leads to toleration of short maternal absences	This object impermanence precipitates panic at maternal absence
	Aggressiveness and temper even higher than in intact	Reaction to danger by increased aggressiveness and temper	*Decreased aggressiveness
	Hyperactivity frequently reported	Free motility in space with rudiments of danger reaction	*Motility markedly decreased unless conditions of absolute safety prevail

*Asterisks indicate predicated direction. Since my experience with deaf-blind infants is minimal as compared to either deaf or blind, I can only speculate in which direction of developmental deviation the deaf-blind child will fall.

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THE USE OF HEARING BY THE DEAF-BLIND

June Miller, Ed.D.

It is a pleasure to be here with you today. My interest in deaf-blind children goes back to when I was a child and Miss Inez B. Hall, a teacher of deaf-blind children, brought letters to our home from a young man named Leonard Doughty, who was learning to talk, read, and write. This experience led me to follow his career. I then became interested in the deaf-blind through the Iowa School for the Deaf and the Alabama program as well as dealing with severely visually-severely auditorially impaired children in our Clinic. Helen Keller was the speaker at commencement when I graduated from Washington University. It was a very exciting experience for me. My friend, Leonard, said "you know Helen Keller really isn't very realistic; she does not have to get on a street car or bus and get to work everyday, she does not have to go grocery shopping, she does not have to figure out how to go shopping for clothes or run a household. She is so popular, there is always someone with her." What are we doing with out hearing-visually impaired children to prepare them to live life as independently as possible or to function at a level in a residential protective environment more adequately? My experience with large numbers of deaf-blind children is minimal.

In the summer of 1953, a friend of mine who is profoundly deaf, while at a Sunday brunch lip-read two ladies across the room who were talking about a deaf-blind child in an orphanage. My friend quickly joined them to inquire about the child. The next day, she contacted me to see if I would see this 7-year-old child. The child did not walk, did not respond to sound, and clawed at herself rather viciously. She was kept in a playpen most of the day, but had learned two things which startled me enough to want to work with her. When carried into the chapel, she had learned to imitate the sound of "shhhhhh" and had learned to cross herself. Here, I found a beginning point. The child's problem was due to retrolental fibroplasia. Today, after many years work, she appears to have normal hearing, is ambulatory, and can speak and make her wants known. While she did not respond to any sound initially, training in mobility, auditory training, and socialization helped her to develop.

About this same time, through our Children's Rehabilitation Unit at the University of Kansas Medical Center, the Staff carried out a one week evaluation program of a group of 10 children who were thought to be deaf-blind. These children were then reevaluated and reexamined by a group from Perkins Institute as our Staff watched. We compared findings and discussed recommendations. During the workshop, one deaf-blind child was wandering around in the preschool room with our deaf children. The adults were observing her trying to determine if the child was functionally blind or organically blind, or if she were so mentally retarded that she was not functioning at all. One of the 3-year-old deaf children walked over, pulled my skirt, and told me that the child could not see and that

she could not hear. That was the fastest diagnosis I have ever seen. We have followed these children since this time. As a team, we moved through the three models presented by Dr. Calvert.

In 1954, we organized a preschool or nursery class for six children who were deaf because of rubella. There were a variety of physical defects. One child was extremely hyperactive and by the end of the first six weeks, the family moved to California, and one year later, the child was institutionalized. Of the remaining five, one is presently enrolled in a small liberal arts college and has just finished her freshman year. She has hearing at all frequencies, reduced visual acuity, and an IQ of 110. Another, with no vision in one eye and reduced acuity in the other, had hearing in the speech range at approximately 65 dB ASA. She too was educated in a special school until high school. At present, she has finished two years in a junior college and has a job in an office. The remaining three who were integrated into the public schools at the age of twelve, had saucer-shaped hearing losses, small eyes, and IQ's in the average range. They have just graduated from high school and plan on attending junior colleges next year.

We have always had children who were deaf or hard-of-hearing or hearing impaired who also had severe visual problems. From these experiences, I have drawn up for myself a series of necessary steps that help me start an educational follow-up.

1. Develop an awareness of sound
2. Recognize sounds of the environment
3. Make the sounds meaningful
4. Develop communication with and for the child

In order to implement education implications of the audiological evaluations, the audiologist, the teacher, the psychologist, the social worker, and the parents must work very closely together in order to provide the social, emotional, and mental atmosphere in which a child can grow mentally and physically, expand, investigate, learn, and develop communication throughout his entire education. When the child is initially seen, the parents usually present a picture of being overwhelmed by the problem. Their confusion is, of course, reflected in the child's behavior which is already abnormal because of the handicap. The child may know nothing about the world and the observation actually gives us very little information. We, therefore, must follow Thorndyke's recommendation of "test, teach, retest, reteach" throughout the child's entire development. While most use the term, "deaf-blind" children, "auditorially-visually impaired" might be more appropriate. Actually, few children are totally deaf and blind. Consequently, there is usually some vision and hearing with which to begin their education in conjunction with the other senses. Therefore, after diagnosis, it is imperative that the child's education be started at the earliest possible time and that he be given every opportunity to observe, feel, smell, react, and investigate his environment.

As an example of lack of stimuli, we observed a child, with rubella etiology, whose mother had attempted an abortion and suicide. The Staff knew that this frightened young woman would not let the child's father touch the child for fear he might drop him. The examiner started out with the baby on a cart and would make a sound, pick the child up and love him. Make a sound, pick the child up and love and pat him, make a sound, and sometimes tickle him. We wanted to be as warm and friendly as possible. Responses to sound were obtained. The mother finally said, "you look like you are having fun." The examiner tried to get the mother to follow her example with the same kind of reaction -- tender, loving care -- that is so necessary for all human beings. The child needs to investigate his environment. Of course, this is not always as easy as it may seem. There must be sounds associated with eating, sounds associated with taking a bath, sounds associated with getting ready to go for a ride in the car, sounds associated with everying that a child will come in contact with during his very early years. He needs to be encouraged to reach out. These sounds need to be the kinds of sounds that do not startle or frighten the child so that he will not turn us off. For example: The mother should slam a door, then walk into the room and pick him up. There could be the sound of foot steps, a slamming of the refrigerator door, followed by a pleasurable act like eating or drinking. Another example might be the parent and child holding a toy, then dropping it on a hard surface to make a noise, or letting the child hold a spoon and beat on a dish pan or high chair table. Help the child to get tactile, auditory, and kinesthetic feedback that is associated with his environment. The teacher and parent should always encourage and praise the child when he has responded appropriately by means of a pat or hug to reinforce the desired behavior. It has been our experience that many of these children are not very interested in food and, therefore, candy or food is not an appropriate reinforcement for their activities. If the child has even a small amount of vision, give him the opportunity to use that vision and to associate the visual image with the environmental sound activity. It appears that many auditorially-visually impaired children rock, "head bang," and pick at themselves senselessly, and engage in other types of "blindisms." They are bored. Perhaps they need a type of activity such as throwing rocks into a bucket, or throwing beans into a can. Also, teaching them to use noise-makers creates a sense of accomplishment within the child and may help develop some use of the midline. The same noise-makers can be carried into a sound-treated room so that the audiologists can continue his testing, thus giving us more information as to whether we have some responses to the high tones as well as the low tones.

The parent and teacher should talk in the child's ear at this stage. Singing, talking, laughing, cooing, babbling, and calling his name can be fun. For example: "I am putting on your shoe." "In goes your foot, push, push, push, tie the bow." He is going to be wiggly. I never saw a child yet who wanted to have shoes put on. At all times, try to make sounds meaningful. Whetnall and

Fry (8) in The Deaf Child have said repeatedly that the child must have many early experiences with sound and that they should be loud enough and often enough. This examiner would like to add, that it must not only be loud enough and often enough, but it must be meaningful and attached to his environment. The research in educational psychology has reported that meaningful information is learned more rapidly and retained longer than nonsense material. Make the experience meaningful! At the same time, place the child's hand on the face, lips, chin, chest, on the top of the head. The latter can be very dangerous. Many children are at the stage of hair pulling. Nevertheless, the child should feel the vibrations. As we try to help the child to stand and walk, sing "walk, walk, walk, walk, walk, walk" and as you pick him up, you sing "up you go, up you go, up you go," or if you are going to put him down, say "down, down, down, down, down, down, down, down." Sometimes the speaker will say it loudly and sometimes he will say it softly, sometimes in a sweet voice, and sometimes in a firm voice, always making sure that the instructor ends up with the child's having had a very pleasant experience. As reported by our previous speaker, the use and development of all the senses is extremely important during those early years. Many have been educated for many years who did not enter school until they were 6, 7 years of age or more. However, the researchers today say that the optimum time in the development in the use of hearing is during the very early years.

As soon as the teacher, the parent, and the audiologist are sure of the hearing loss, a hearing aid should be fitted. The aid should be selected as early as possible; however, the parent and child should have educational guidance. The audiologist and teacher must educate the parent to put on and take off the hearing aid and to change the batteries. The child must be seen a number of times by the audiologist so that he can determine whether the ear mold is comfortable, whether the volume setting is appropriate, not too loud and causing more loss, whether the voice production of the parents is appropriate. Once it has been determined that the hearing loss is established, it is then much easier to develop a program. There are some children who will only respond to 125 H_z, 250 H_z, and 500 $_zH$. This is the type discussed by van Uden (7) as "vibro tactile." The child receives the majority of his experiences through the vibratory senses. The child who has responses to the majority of the frequencies in the speech range will profit far greater with the use of his hearing aid. True, they may never be able to discriminate between a list of PB words. The audiologist may not be able to determine a speech threshold, but a speech awareness threshold. Experience has shown that the earlier the child starts, the more rapid his progress and the better use he will make of whatever residual hearing he possesses. Other children may give responses to sound at frequencies of 250 H_z, 500 H_z, 1000 H_z, 2000 H_z, 4000 H_z, and 8000 $_zH$ when amplified. They profit from sound to a greater degree.

We must assume that there are no two auditorially-visually impaired children that are alike. We hope that the teacher is endowed with a great deal of imagination, creativity, enthusiasm, love, and inspiration, and can really accept a challenge. We must also assume that the teacher is a person who is saying "I think I can, I think I can, I think I can" rather than "I don't think I can, I don't think he can, I don't think he will, I know he won't, he isn't doing anything." The Rosenthal effect or aspirational level may affect the progress of our children. Each child must have his own individualized program.

Another profoundly deaf friend of mine whom I have watched develop through the years, walked into my office when she was 40 years of age and said "I have lost almost all of my vision; the State plan has taught me to fingerspell and sign, I can communicate with many people, but I would like to be able to use the Tadoma Method. Do you think I am too old to learn?" This lady was a fabulous speechreader, and even in the days when she was beginning to have a severe visual problem, she would put your head under a light and speechread in a phenominal way. By fingerspelling to her, the speaker would start to spell to her and she was able to complete the sentence because her knowledge of sentence structure and word order was so great. She was able to complete the sentence almost before the speaker was able to complete the thought. She did go East, she did take lessons and has developed some skills up to a certain point in this ability. She can communicate with a few colleagues at work. Therefore, the teacher should not give up if he has not started with a child as early as he wishes. Delaying their start in school will present many more problems, such as the development of inappropriate behavior and the tragedy of missing opportunities afforded in their environment. Some deaf-blind adults do use their hearing to answer the telephone and door bells, etc.

There must be a very careful introduction to the hearing aid, both for the child and the parent. It should be placed upon the child for very brief periods of time with very interesting experiences. Some children may only get rhythm. Other children may get long vowels or the primary portion of a dipthong. Other children will hear all of the vowels and some of the voiced consonants. The audiogram does not always predict how a person will use the residual hearing that he has now nor will it indicate how well he will be able to use it. It has been the writer's basic premise that practically all of the deaf have some hearing which is usable and it should be utilized to the maximum. There are very few individuals with no hearing. For the deaf-blind person, it is important to use even a minimal amount of hearing as a protective device. For instance, air raids, tornado warnings, honking cars, doors slamming. The child needs to be observed to determine whether he has developed any symbols, any babbling, any reactions to sounds that can be used to help structure his world. We all know that the normal hearing child develops language through reacting to the various stimuli

in his environment, and that he goes through a variety of steps, including the imitation of one word, expanding this word into kernal sentences and then into larger and larger groups of words. For example: all doggies are four-legged and then suddenly, the child is calling a cat a doggie, a horse a doggie, a cow a doggie and, of course, is corrected by the family each step along the way to help him understand. The instructor of the deaf-blind wants to discover the natural signs, gestures, or vocalizations that the child has in order to help him to begin to express his ideas as they relate to his needs. This includes imitating frequently the child's sounds. For example: if you are going to wash his hands, say "Iam going to wash your hands" and then, actually wash his hands. If you are going to eat, pick up his hand as if you were putting a spoon in it and move it towards his mouth saying, "It is time to eat, it is time to eat, don't you want something to eat, what would you like to eat?" Then, he eats. Then say, "you ate your dinner." While he may not understand the language, he is being given an opportunity to associate language with an experience and with an attitude within his environment. Speech or sounds or babbling become meaningful for the child when he uses them to manipulate the environment. Things that are meaningful for a child are things that he can do. A tree is for climbing, a box is something to fill or to sit on, a ball is something to throw. He needs also to be aware of his own body, his eyes, his nose, his mouth. He needs to begin to not only know himself, but to imitate the world around him so that he gets some feeling for the experience and an association of movement with language, with sound, with what is expected of him in the future. He will invent gestures, movements, tones, babblings that will have meaning. The teacher can expand these through the use of the tactile, auditory-visual input, whatever it may be. As has been said so many times before, the major handicap of deafness is the acquisition of language, and for the blind, the need for mobility.

When the child is quite young, the parent does the teaching guided by the teacher. Later, the teacher carries out activities when she uses sound and speech through amplification. This helps him to develop the personal awareness, the social awareness, the social behavior of self-care, the ability to play, and the ability to move about. The physical activities and the manipulation of materials within his environment all help him to learn and to think. All of the time the teacher is helping him through perceptual training, such as tactile experiences, auditory experiences, visual experiences, and olfactory experiences, she is communicating with him through tactile, visual, auditory, and kinesthetic stimuli to give him a concept of the world about him.

Bone conduction vibrators have been successfully used with deaf children. They are placed in the hand of a child to help to increase his rate of utterances. Drisko, in an unpublished Master's Thesis, reported an increase of rate in speech production. She increased the rate of oral utterances by letting the child feel the bone vibrator when the signal was placed on an audio-tape.

Guberina (4) has used a bone oscillator to encourage and increase the rate and rhythm of the oral utterance. Børrild of Denmark (1,2) (Proceedings of International Conference 1967, Vol I), has used a large chromium vibrator attached to his amplifier -- visual feedback equipment to give the deaf child more input, improve his rhythm, increase the rate of speech, and decrease the length of the vowels. There is also a piece of equipment available in Denmark that uses a bond oscillator on each finger as the signal is passed through a series of bandpass filters. The lowest sound is transmitted to the little finger of the left hand and the highest sound to the little finger of the right hand. It would be of interest to determine if audiologists have attempted to use bond conduction vibrators in conjunction with an aid conduction hearing aid to determine if there could be an increase of the sensitivity of input. There are a number of studies (4,5) with regard to the use of two aids at ear level. It has been demonstrated that two aids placed on the head improve the threshold for speech by 3 dB over monaural presentation. The person with a hearing loss often finds that this 3 dB may be of great benefit. There have been other studies indicating that there is a greater increase in sensitivity in some of the higher frequencies (5). For the visually-auditorially impaired child, even the 3 dB may give him additional information that is helpful. There are other studies that give some indication that the stimulation of two ears for the high frequencies may be even more helpful. This does not seem so important for the person with normal hearing. Of course, there is always the question of the cost of the two aids and becoming adjusted to them. There is also the fact that when the aid is worn on the body, even though you are stimulating two ears, the patient does not get the benefit of localization. With children as impaired as the ones we are talking about, there seems to be some indication that this summation with both ears would be helpful in the educational process.

During 1968-1969, the International Education of the Hearing Impaired Film Series (6) was produced by Dr. Ann Mulholland and George Washington University Medical Center. I have chosen two films to be viewed, one on the "Deaf-Blind" and the second on "The Sound Perception Method." The "Deaf-Blind" film is of 23 minutes duration and covers techniques of evaluation by Dr. Fisch Heston, Auditory Clinic, Middlesex, England and the approaches to instruction at St. Michielsgestel, Holland, Netherlands (7). These films are available through Media Services and Captioned Films, Media Distribution Center, 5034 Wisconsin Avenue, N.W., Washington, D.C. 20016. The second film, "The Sound Perception Method," shows the method of instruction used at the Institute for the Deaf at St. Michielsgestel from home visits through integrated secondary schools for hearing impaired. "The Sound Perception Method" has been used to develop self-awareness, grace of movement, rhythm, awareness of sound, feeling for sound, and the world about. The use of vibration, tactile, and kinesthetic approaches attached to minimal auditory and visual clues should move the child towards the development of communication.

In summary, this paper has attempted to bring information with regard to the use of residual hearing for deaf-blind children. The instructor must accept or reject these ideas as they relate to each child with whom he works. All of these children are more different than they are similar. Many have additional deficits. This was not a review of the literature from the field of the deaf-blind. That literature is available to you and the assumption was made that you, the reader, have already read it. Since the group has had a year's experience, it is recommended that you reread the proceedings of the special institute (9) held a year ago by this group for teachers of the deaf-blind children. The children with whom you work will teach you a great deal. Don't be rigid. Enjoy the children and be creative. There is no one and only answer.

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HEARING LOSS WITH REFERENCE TO ETIOLOGY

C. P. Goetzinger, Ph.D.

My discussion today will be primarily in terms of deafness with the implication that much of what is known about the impact of hearing loss, and etiology of the impairment upon language acquisition and educational achievement, will also apply to the handicap of deafness-blindness. I should like to note that a number of years ago in California, I had some experience in administering hearing tests to the deaf-blind at the Berkeley School. However, at that time, our tests were not advanced enough to attempt any inferences with reference to the results. Furthermore, etiology, as reported in the school records, was somewhat imprecise, and in general, grossly defined so as to make any study of the relationships of audiological data virtually meaningless. Apparently, some data on the deaf-blind have been collected, but I frankly was not able to locate them in the literature, if they have been published. Briefly, then the purpose of my talk is to discuss some of the implications of the etiology of deafness to the prognosis for the acquisition of language and education in the hope that they (the implications) will be reasonably applicable to the double handicap of deafness and blindness.

In order to reorient you to the classifications of hearing impairment as they relate to the audiogram, Figure 1. was prepared.

The figure, as you will note, is in terms of the ISO reference level. As shown, a reduction in hearing sensitivity which falls within the range of zero to 25 dB is regarded as a hearing level which is within normal limits. However, the hearing levels within the 25-40 dB classification constitute a slight hearing loss. Hearing levels which fall between 40-55 dB level are indicative of a mild hearing loss, whereas those between the 55-70 dB range, are considered marked. Individuals with hearing levels at the 70-90 dB classification have severe hearing losses. Finally, those with hearing levels at 90 dB or greater are classified as having extreme hearing loss. For medical-legal purposes, hearing levels which average greater than 25 dB for the speech frequencies of 500, 1000, and 2000 cycles by pure tone air conduction audiometry are compensable if induced by virtue of occupation. The use of a hearing aid must be considered when the hearing loss in the better ear exceeds the 40 dB level and is permanent.

There are several basic types of audiograms. In other words, one may suffer a hearing loss as a result of a pathological condition in the outer ear, the middle ear, the inner ear, or centrally. In order to clarify the preceding statement, I have included slide 2 which is a cross-section of the ear.

As you will see, the outer ear is defined by the external auditory canal up to the drum

membrane. The middle ear is the small cleft, medial to the drum. It contains the three ear bones, or ossicles, and other structures. Next, you see the inner ear which is medial to the middle ear cavity. The inner ear is located in the bony labyrinth which is within the petrous portion of the temporal bone or the pyramidal bone. Within the bony labyrinth is the membranous labyrinth consisting of three ducts. Within the medial duct is the organ of Corti with its hair cells. This is the analyzer of sound. As shown on the slide, the third little bone, or stapes, fits into the oval window on the medial wall of the middle ear cavity. The oval window is located at the vestibular duct of the inner ear. At the other end of the tube is the tympanic duct, and at the tympanic duct is the round window which serves as a release valve. The eighth nerve, or nerve of hearing, leads from the cochlea through the internal auditory meatus to the brain stem, and then up to the hearing center in the brain. Sound waves strike the eardrum which, in turn, moves the ossicular chain. The third bone in the ossicular chain, or the stapes, rocks back and forth in the oval window, thereby causing a traveling wave in the fluid of the vestibular duct. The traveling waves cause the hair cells in the middle duct to bend back and forth, thereby setting electro-chemical impulses in the eighth nerve which, in turn, travel to the brain and is then interpreted as sound. When the fluid in the inner ear is moved at the stapes, there has to be some sort of release valve so that movement may occur in the inner ear. This is provided by the round window.

There are several types of hearing loss. The first type which we will mention is conductive hearing loss. The next slide shows a conductive hearing loss. The distinguishing features of a conductive hearing loss are: (1) a hearing loss by air conduction; (2) normal or near-normal hearing by bond conduction and normal auditory discrimination. The slide (3) shows a 33 dB loss (average of 500-1000-2000 Hz) through the speech frequencies by air conduction with bone conduction being within normal limits. Such an audiogram represents a slight loss of hearing. As you will note by the cross section of the ear below the audiogram, the hearing loss was causes by otitis media, or an infection in the middle ear. Both the external ear and the inner ear were normal in this particular case. It happened to have been a child with a cleft palate. Conductive hearing losses may vary from very slight to severe hearing losses.

The next slide (4) shows the maximum hearing loss that can occur as a result of a conductive hearing pathology. Bone conduction is normal; however, the air conduction is down 60 dB (ISO). One frequently finds a conductive hearing loss of this magnitude in cases of congenital atresia. As illustrated by the cross section of the ear, in congenital atresia, the pathology is usually associated with the external and middle ears. The inner ear is normal. In congenital atresia, the ear canal may fail to develop. In addition, the middle ear may be either absent, or else severely malformed. Many people with conductive hearing losses benefit from surgery. In general,

they are excellent candidates for hearing aids if they do not elect to have surgery. This fact is so primarily because they have excellent auditory discrimination. Their hearing loss is merely a mechanical blockage of the outer and middle ears so that when sound is made loud enough, the patterns are carried to the brain relatively undistorted.

The Treacher-Collins syndrome is an example usually of a maximum conductive hearing loss. It consists of hearing loss of the conductive type, microtia, atresia of the external canals, malar and mandibular hypoplasia, and usually, malformation of the ossicles. Other characteristics are antimongoloid papebral fissures with notched lower eyelids. The disease is hereditary and due to autosomal dominant transmission (Konigsmark, 1969).

An important consideration with reference to conductive hearing loss is that, regardless of its degree (maximum, as previously noted, is about 60 dB or so ISO), it does not preclude the development of language through the ear. Other things being equal, such as normal intelligence, children with congenital atresias and conductive hearing loss will acquire speech and language primarily through the auditory channel. The reason for this is that speech which is loud enough to override their hearing deficit, is transmitted to the hearing center in the brain relatively undistorted, as contrasted with sensorineural hearing loss of the same magnitude in which there is likely to be serious distortion. This is so because of damage to the cochlea which is the analyzer of sound. Clinical observations tend to indicate that bilateral conductive hearing loss when obtaining from birth, induces about a 2½-year retardation in language development when intelligence is normal as measured by performance tests (Goetzinger, 1962). When early habilitative measures are undertaken with such children in conjunction with hearing aids, the retardation is rapidly reduced.

I recently received a letter from Dr. Edwin Hammer of the Callier Hearing and Speech Center in response to an inquiry by me relative to research with the deaf-blind. He commented on the research of Phyllis Fishman of Callier who has completed audiometric and impedance study of 60 deaf-blind children. She found 42% of them to have indications of middle ear problems. As previously implied, hearing losses of middle ear origin may frequently be eliminated or reduced by surgical intervention and by medical treatment.

Sensorineural hearing loss is associated either with injury to the hair cells of the cochlea because of disease, trauma, and so forth, or with mal-development of the cochlea as a result of a hereditary deficit. The next slide illustrates a sensorineural hearing loss (Slide 5). Note particularly that bone conduction is superimposed on air conduction.

As shown by the cross section of the ear, in sensorineural hearing loss, the external and middle ears are normal. The injury, however, is in the hair cells of the cochlea. Sensorineural

hearing loss may vary from very slight to total deafness. Generally speaking, auditory discrimination decreases as hearing loss increases. Other differentiating audiological findings in sensorineural hearing loss are the presence of recruitment and either a lack of tone decay or minimal tone decay. As you are well aware, maternal rubella is frequently a cause of sensorineural hearing loss. Gregg, in 1941, recognized that rubella was a cause of malformations. Within the last 10 years, laboratory tools became available for the isolatior of the virus and antibody. Also, it was found that maternal rubella could result in transmission of the infection directly to the fetus.

Malformations, stillbirths, prematurity, and mental retardation have been associated with rubella. The defects involve the eyes, heart, hearing, and intellectual development. The second month of the first trimester of pregnancy appears to be the period during which damage to the hearing mechanism results from maternal rubella. During the first 12 weeks of pregnancy, the damage includes poor differentiation of hair cells, cytoplasmic destruction of the organ of Corti, and a reduction of blood vessels in the stria vascularis. The site of lesion is in the inner ear.

Matkin et al (1967) evaluated 32 children with a history of maternal rubella in 1966. The average age of their subjects was 22 months. Using a variety of stimuli such as recorded sounds, environmental sounds, monitored live voice, the sound of toys, and so forth, they reported a median hearing loss of 72.5 dB ISO. They noted that about 75% of their cases fell in the moderate and severe classifications of hearing loss and that the range extended from mild to profound deafness.

Miller, Rabinowitz and Frost (1969) recently reported sound field evaluations on 252 children with a history of maternal rubella. The results indicated that 57.9 per cent had significant loss of hearing. Of the 57.9 per cent with hearing loss, seven per cent were classified as mild (16-29 dB ASA), 12.3 per cent as moderate (30-44 dB ASA), 7.1 per cent as moderately severe (45-59 dB ASA), 7.0 per cent as severe (60-79 dB ASA), 9.9 per cent as profound (80 dB + ASA), and 14.2 per cent as questionable.

Vestibular tests were also performed on 137 subjects. It was found that 36.4 per cent gave normal responses. Of the remaining 63.6 per cent, almost half (46.9 per cent) were reported to have some degree of vestibular abnormality.

The next slide (6) shows the median hearing loss for the right and left ears of 42 children with a history of maternal rubella in a School for the Deaf. The median instead of the mean was used because of the absence of responses so frequently at the maximum output of the audiometer. Clearly, the median hearing level of these subjects is in the profound or extreme hearing loss classification. It will also be observed that the median I.Q. of the subjects is 98, which is normal. The median C.A. was 12 years, 11 months.

In order to provide a more detailed view of the data, the average hearing losses of the three speech frequencies, 500-1000-2000 Hz, were computed for the right and left ears of each subject. A median hearing loss of these data was determined then for each ear. These medians, as well as the ranges, are also presented on the slide as shown. The median hearing losses of 97 and 100 dB respectively for the right and left ears are in close agreement with the median pure tone curves. The ranges both for the right and the left ears are large, extending from 43 to 110+ dB* in the right, and from 30 to 110 dB in the left ears. Briefly, half of the subjects had average hearing losses which ranged from 30 to 100 dB ISO in one or the other ears. This finding suggests that about one-half of the subjects could get substantial help from auditory amplification using the audiogram as a guide. To study this result in greater detail, the average hearing losses, through the speech frequencies for both ears of each subject, were examined for sensitivity. It was found that 27 of the 42 subjects had a hearing loss of less than 97 dB ISO in at least one ear. Hearing losses of 80 dB ASA or 90 dB ISO are regarded usually as the demarcation between severe and profound or extreme deafness. Actually, 21 of the subjects had hearing losses in at least one ear of less than 90 dB ISO. Thus, one-half of the subjects could expect rather substantial help from auditory amplification.

Meningitis has been a major cause of deafness in children. It is an inflammation of the meninges or covering of the brain and spinal cord. The infection can be caused by certain bacteria, viruses, or fungi. Meningitis may or may not be related to a previous illness. More explicitly, tuberculous meningitis follows tuberculosis elsewhere in the body, whereas meningococcal meningitis is not related to an existing infection. In addition to the tubercle bacilli and the meningocci, the hemophilus influenzae, pneumocci, and streptococci are other bacteria causing meningitis. Meningococcal meningitis and tuberculous meningitis are commonly associated with deafness. Treatment involves the use of sulfonamides and antibiotics. Although mortality has decreased from almost 100 per cent to one in ten with adequate drug therapy, permanent sequalae may occur if the disease is not checked in the early stages. The sequalae may include hearing loss, paralysis of one or more extremities, paralysis of third, fourth, and sixth cranial nerves (usually causing cross-eyes), mental retardation, irritability, restlessness, and convulsions.

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*The average of the hearing loss for the speech frequencies (500-1000-2000 Hz) was computed for each ear of each subject. Median hearing losses for the right and left ears of each group were computed. Failure to perceive a tone at any one of the speech frequencies (500-1000-2000 Hz) was weighted by assigning 110+ dB and using this number in the average. Example, RE=50 dB at 500, 80 dB at 1000, and NR (no response) at 2000. $50 + 80 + 110+ = \frac{240}{3} = 80+$ dB hearing loss as compared to 80 dB for 50 dB at 500, 80 dB at 1000, and 110 dB at 2000. The plus (+) therefore indicates that the average loss was greater than 80 dB, and also that there was a NR at one frequency at least. Example 2, 110+ dB would indicate that there were no responses: (NR at 500; NR at 1000, NR at 2000) = 110+ dB + 110+ dB + 110+ dB = $\frac{330+}{3}$ = 110+ dB.

Animal studies indicate that meningococcal meningitis deafness is due frequently to neuro-labyrinthitis. In any event, the eighth nerve, cochlea, and labyrinth are frequently destroyed. The meningitically deaf child usually seen in schools for the deaf has a balance problem which is particularly in evidence at night in the absence of light. Since visual cues are minimal, and the child is dependent upon them in walking, he usually manifests a staggering gait in the dark. Such children also have problems associated with swimming post meningitically, and must learn to use their eyes under water for orientation.

Although hearing loss in post meningitic deafness is commonly bilateral, severe, and permanent, it can be affected by treatment such as in the use of streptomycin. Trolle (1950) followed 327 subjects for at least three years to 27 years. He reported six types of audiograms including (1) total deafness; (2) unilateral deafness; (3) sloping curve; (4) abrupt decline; (5) flat loss; and (6) conductive loss. Many of the cases had vestibular problems (balance). However, he did not find progressive loss as mentioned by several authors. The writer, however, had a case in which hearing deteriorated from about 65 dB bilaterally ASA to total deafness over a period of about three years (Goetzinger, 1947).

Figure 7 shows the type of audiogram not infrequently found in children in schools for the deaf. In short, there is profound deafness. In this type of hearing loss, the cochlea, vestibuli (not shown), as well as the eighth nerve, are involved. Generally speaking, the external and middle ears are normal, although the latter can be affected.

In Figure 8 are shown the median thresholds by air conduction for the right and left ears of 15 children who suffered deafness as a result of meningitis. Hearing loss, as will be noted, is profound or extreme. The median age of those children was 15 years, 10 months. It will be noted also that the median I.Q. of 98 is normal. Also shown are the median hearing losses and the ranges of the average losses for the speech frequencies for the right and left ears. The median losses of 97 and 92 dB respectively for the right and left ears indicate extreme deafness. However, the ranges of 30 dB to 110+ dB characterize considerable variability extending from slight impairment to total deafness (110 + dB means that no responses were elicited at the maximum output (110 dB) of the audiometer at 500-1000-2000 Hz). Inspection of the individual scores revealed, as in the instance of the rubella cases, that nine of the 15 subjects had hearing loss in at least one ear, of less than 90 dB ISO, suggesting again the possibilities of auditory amplification with this group.

Figure 9 shows the median thresholds for ten subjects (C.A. 15 years, 6 months with I.Q. of 83) who were reported as brain-damaged due to birth injury. Also included are the median thresholds (RE=98 dB; LE=86 dB) of the pure tone averages for the right and left ears, as well as the ranges. Although the median threshold curves seem to be more sensitive than either the rubella or the

meningitic subjects, the differences are not as pronounced as they appear. For example, of the ten cases, five had average thresholds for the speech frequencies of less than 90 dB ISO, and five had average thresholds greater than 90 dB. The median I.Q. of 83 for these children is distinctly poorer than for the other groups.

There are, of course, numerous other non-hereditary causes of hearing loss associated with maternal infections, such as influenza, glandular fever, and Asian influenza; those attributable to drugs and chemicals, as streptomycin, quinine, and salicylates; other perinatal causes as haemolytic disease due usually to Rh incompatibility and prematurity; those caused by other post natal infections as mumps, scarlet fever, etc.

Hearing loss resulting from Rh incompatibility has been of concern during the past decade (Matkin and Carhart, 1966; Matkin and Carhart, 1968). Hearing loss may occur when neonatal jaundice results from Rh incompatibility involving an Rh negative mother and an Rh positive child. The mother during the first pregnancy is sensitized to the Rh positive cells of the baby to produce antibodies against them. The antibodies cross back through the placenta to the baby and induce a breakdown of the baby's red blood cells. Normally, the fetus liver is able to metabolize bilirubin which is a breakdown product of hemoglobin. However, because of increased bilirubin and an immature liver, the bilirubin precipitates in the fatty tissues throughout the body and the central nervous system. When bilirubin precipitates in the brain, the situation is called kernicterus and erythroblastosis fetalis. Jaundice refers to the yellowish color produced by the bilirubin pigment.

Kernicterus is a term used to describe the neonatal symptoms characteristic of the brain damage of icteric encephalopathy. The jaundice which causes posticteric encephalopathy may be due to many factors, one of which is Rh incompatibility. The late sequelae of posticteric encephalopathy constitute (1) athetosis; (2) gaze palsy; (3) dental enamel dysplasia; (4) auditory imperception in about 50 per cent of these children, and high frequency hearing loss.

Many investigators concluded that Rh incompatibility is central rather than peripheral. Although histological studies are few, changes in the cochlear nuclei have been observed in a few cases. However, early audiological studies indicated a cochlear site of lesion (Blakeley, 1959).

More recently, Matkin and Carhart (1966) studied 22 subjects with a battery of tests consisting of pure tone air and bone conduction, the SISI Test, Bekesy audiometry, tone decay, monaural loudness balance, and median plan localization. The results from all tests were consistent with cochlear lesions.

In another study, Matkin and Carhart (1968) utilized electrodermal audiometry and pure tone audiometry with Rh subjects. Significant differences from normal were not obtained by EDA. The

authors pointed out, however, that the selectivity of their sample (they chose subjects only with hearing loss) may have biased the results.

Furthermore, they hypothesized that kernicteric damage to the cochlear nuclei may produce hearing loss which parallels the symtomatology of cochlear lesions.

The pure tone thresholds of four subjects with hearing loss which was reported to have resulted from Rh incompatibility in my data, fell within the severe to extreme classifications of deafness. Three of the subjects had normal intelligence and one an I.Q. of 80. However, no audiological test data were available relative to site of lesion. It would appear that hearing loss in association with Rh factor can be severe at times.

In 1951, Waardenburg (1951), a Dutch ophthalmologist, described a genetic syndrome which subsequently has been characterized by his name. He hypothesized that the syndrome was inherited in an autosomal, dominant manner. It consisted of a number of characteristics, which could be manifested in different combinations. The most prominent signs were (1) perceptive deafness; (2) shortening of the eye fissures, horizontally because of lateral displacement of the medial canthi and lacrimal points of the eyelids; (3) a broad nasal bridge, more apparent than real, which is due to eyelid deformity; (4) hypertrichosis of the eyebrows; (5) a white forelock usually in the midline; (6) heterochomia iridium partial or complete; and (7) dappling of the skin.

The most frequently found audiological characteristic of Waardenburg's syndrome is severe bilateral sensorineural deafness (Fisch, 1959). In conjunction with the aforementioned type of hearing loss, another audiometric configuration frequently found is unilateral hearing impairment of moderate degree. Other types of hearing loss configurations have also been reported (Marcus, 1968).

Figure 10 shows the median audiograms for the right and left ears of seven cases with Waardenburg's syndrome. Also shown are the medians for the three frequency average (500-1000-2000 Hz), as well as the ranges. The median hearing losses of 103+ dB and 103 dB for the two ears indicate extreme or profound deafness. As will be noted, the median I.Q. of 104 is indicative of normal intelligence, a finding which is consistent in the literature. The median C.A. was 14 years, nine months.

In addition, to the Waardenburg and the Treacher-Collins Syndromes of hereditary deafness, there are several other syndromes which are not as easily recognized and are relatively rare.

The Klippel-Feil syndrome was described in 1912. It is characterized by (1) a congenital short or practically absent neck; (2) the hair line is low at the back of the neck; (3) there are usually a number of deformities including perceptive deafness of varying degrees, and paralysis of the external muscles of the eyes. Intelligence may or may not be affected. Spina bifida is

usually present.

Another syndrome is Van der Hoeve's. This syndrome consists of osteogenesis imperfecta or fragilitis ossium, blue sclera, and deafness. The blue color of the sclera is transmitted as an autosomal dominant gene. About 60 per cent with blue sclera have brittle bones, and about 60 per cent develop hearing loss before age 20 years.

Pendred's Syndrome is associated with deafness, usually present at birth, and goitre which develops in middle childhood. The hearing loss is sensorineural and the audiograms show high tone loss. Inheritance is recessive and the deafness is considered to be an independent expression of the same defect that caused the goitre.

According to Schuknecht (1967), Waardenburg's syndrome is associated with ectodermal dysplasias, "particularly pigmentary alterations." Usher's syndrome likewise is essentially ectodermal with the characteristic features being sensorineural deafness, retinitis pigmentosa, vestibulocerebellar ataxia, and mental disorder.

Conversely, Gargoylism (Hurler's disease), Marfan's, Alport's, Jervell's, as well as Pendred's syndromes, are essentially mesodermal.

Hurler's disease is a growth disturbance involving skeletal deformity, mental retardation, blindness, enlargement of the liver and spleen, and sometimes deafness. It is probably hereditary and of the recessive type.

Marfan's Syndrome is characterized by deafness (sensorineural, conductive, or both), ectopia lentis (dislocation of the lens), heart, lung, skeletal, muscle, ligament, and cartilage anamolies. It is essentially a mesodermal abnormality.

There are also heredo-degeneration and chromosomal aberrations associated with deafness.

Finally, there are the aplasias of genetic origin. Michel's type of deafness is characterized by a complete failure of development of the inner ear. The external and middle ears may be normal. Mondini's type of aplasia consists of incomplete development of the bony and membranous labyrinth. The Alexander type of aplasia results in high tone sensorineural hearing loss which is congenital, familial, and non-progressive. There is also another variation which is characterized by a basin-shaped audiogram. They have very good auditory discrimination.

A fourth type of congenital hereditary aplasia is Schiebe's cochleo-saccular impairment. The bony labyrinth is fully developed. The utricle and semicircular canals are normal. However, the saccule and the cochlea are deformed and present many anomolies of development. The spiral ganglion is reported to be normal (Schuknecht, 1967). According to Whetnall and Fry (1964), Schiebe's aplasia accounts for about 70 per cent of the cases of hereditary deafness.

Schuknecht (1967) notes that the important factors which point to a genetic etiology are: a

a family history of deafness, the existence of two or more affected children in a sibship, and the anatomical symmetry of the lesions.

The next slide (11) shows the median hearing losses by air conduction for the right and left ears of 42 subjects from the school for the deaf who had extensive histories of deafness in their families. Seventeen of the children were the offsprings of deaf couples. Five of the couples had produced 13 children with the remaining four having one child each.

It is apparent from the slide that the hearing loss for these 42 children is symmetrical. The medians of the average of the speech frequencies of 90 dB and 93 dB for the right and left ears respectively are indicative of extreme bilateral impairment. However, the range of 45 to 110+ dB is wide, indicating considerable variability in degree of hearing loss. One-half of the children had average hearing losses for the speech frequencies (500-1000-2000 Hz) of less than 90 dB in at least one ear. Also shown are the median age (13 years, four months) and I.Q. of 103.

Next, median hearing losses were computed for the children of deaf parents and those with hearing parents. The curves were essentially the same as those for the total group as presented in Slide 11. Hence, the variables either of deaf or hearing parents did not appear to influence degree of deafness.

In order to obtain an overall view of the hearing curves of the etiological classifications, average thresholds were computed of the right and left ears at each frequency for each classification. It is observed that hearing sensitivity is best for the brain damaged, followed by the hereditary, meningitic, rubella, and Waardenburg groups in that order.

Of the 123 subjects who were included in the study, educational data from the Stanford Achievement Tests, administered in May of 1972, were available on 66. The medians for C.A., I.Q., Paragraph Meaning, and hearing loss are presented in Table 1.

The brain damaged and the Waardenburg groups obtained the highest median scores on paragraph meaning (4.6 grade). Interestingly, the former had the least and the latter the most hearing loss of the several groups. It will also be noted that the Rubella and Hereditary groups were similar, as for example, in age (14-4 and 14-2), in I.Q. (101 and 104), in P.M. (3.8 and 3.8), and in hearing loss (88 and 92 dB vs. 92 and 98 dB). The Meningitics median I.Q. of 98 and paragraph meaning score of 4.1 was slightly better than for the rubella and brain damaged groups. However, they were about 2½ years older. Actually, in terms of achievement (paragraph meaning), no one group was markedly superior, suggesting that deafness, when severe, is the leveling variable. Unfortunately, information relative to the use of hearing aids in connection with degree was not available.

It will be recalled that deafness may also result from lesions in the central auditory nervous system. Such lesions may result from multiple sclerosis. Olsen and Noffsinger (1969), after

extensive audiological testing of patients with multiple sclerosis, have concluded generally that (1) conventional pure tone and speech audiometry are not effective for revealing lesions of the CNS; (2) retrocochlear pathology in multiple sclerosis is subject to complete recovery; (3) damage to the eighth nerve or cochlear nucleus reveals itself in the same manner as damage to more distal parts of the eighth nerve, and finally, many traditional tests cannot be reconciled with traditional interpretation.

The incidence of multiple sclerosis in schools for the deaf is not known. Furthermore, there are no data insofar as I am aware on the effects of hearing loss induced by multiple sclerosis upon educational progress.

As indicated by the data, approximately one-half of the subjects in each etiological classification, with the exception of Waardenburg subjects, had hearing losses of less than 90 dB in at least one ear. This fact, therefore, suggests that even in a school for the deaf, half of the children have residual hearing with which to work. This statement does not imply that those with greater than 90 dB hearing loss cannot benefit from amplification. However, the chances for help from auditory amplification does diminish when hearing losses are greater than 90 dB because of the likelihood of the absence of the cochlea and also, the eighth nerve. Martin Downs, with whom I think most of you are acquainted, has pioneered the idea and the use of polytomography in profound hearing impairment in an attempt to determine the feasibility of using auditory amplification. Perhaps vibrotactile stimulation would be more effective in such cases. I do not know whether vibrotactile stimulation would enhance or help communication as conventionally taught to the deaf-blind. In all probability, most of you know much more about that than I do.

In conclusion, it was indeed a pleasure to address this gathering and I hope that something which I have said might give rise to new ideas concerning the development of communication in the deaf-blind child.

Table 1. Median Ages, I.Q.'s, Paragraph Meaning Scores and Hearing Losses for the Etiological Classifications as Indicated

Etiology	N.	C.A. (yrs.-mos.)	I.Q..	P.M. (Grade)	Hearing Loss (dB) R.E.	L.E.
Rubella	25	14-4	101	3.8	88	92
Hereditary	19	14.2	104	3.8	92	98
Waardenburg	5	14.9	104	4.6	103+	108+
Brain Damaged	5	15-3	88	4.6	73	78
Meningitis	12	16-10	98	4.1	91	84+

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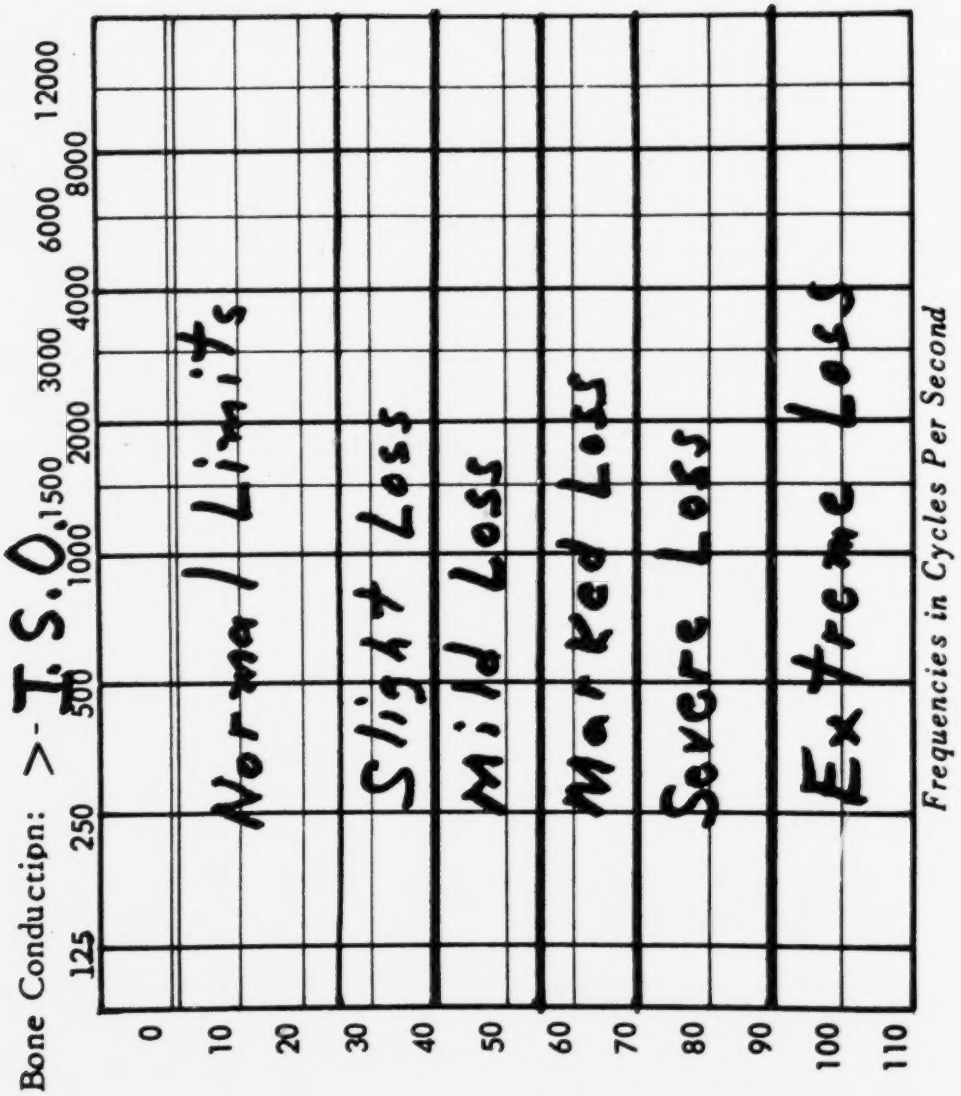
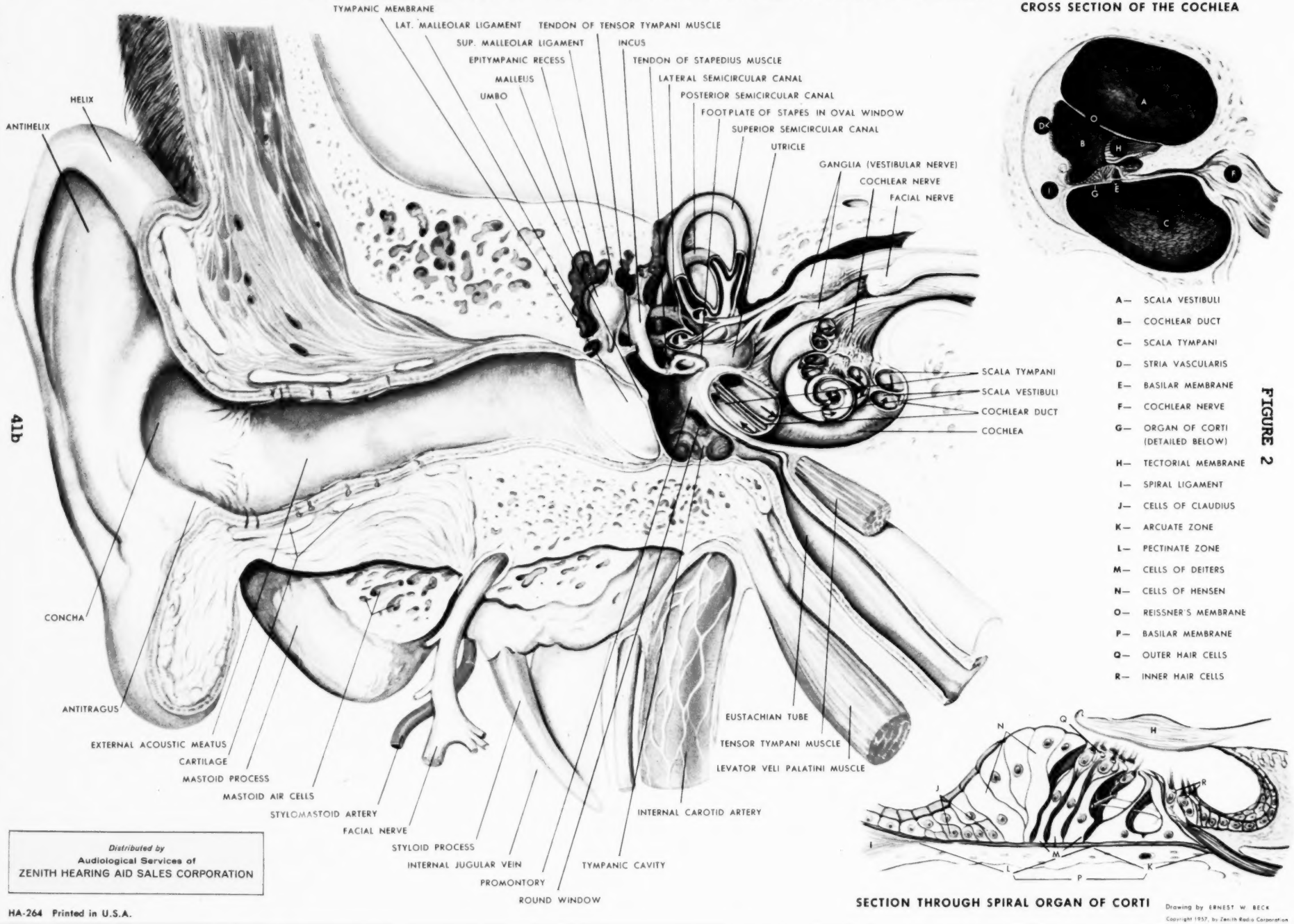
FIGURE 1


Bone Conductipn: >- I. S. O.
125
250
500
1000
1500
2000
3000
4000
6000
8000
12000
0
10
20
30
40
50
60
70
80
90
100
110
Normal Limits
Slight Loss
Mild Loss
Marked Loss
Severe Loss
Extreme Loss
Frequencies in Cycles Per Second

ANATOMY OF THE HUMAN EAR



41b

CROSS SECTION OF THE COCHLEA

A— SCALA VESTIBULI
B— COCHLEAR DUCT
C— SCALA TYMPANI
D— STRIA VASCULARIS
E— BASILAR MEMBRANE
F— COCHLEAR NERVE
G— ORGAN OF CORTI (DETAILED BELOW)
H— TECTORIAL MEMBRANE
I— SPIRAL LIGAMENT
J— CELLS OF CLAUDIUS
K— ARCUATE ZONE
L— PECTINATE ZONE
M— CELLS OF DEITERS
N— CELLS OF HENSEN
O— REISSNER'S MEMBRANE
P— BASILAR MEMBRANE
Q— OUTER HAIR CELLS
R— INNER HAIR CELLS

FIGURE 2

SECTION THROUGH SPIRAL ORGAN OF CORTI

Distributed by
Audiological Services of
ZENITH HEARING AID SALES CORPORATION

HA-264 Printed in U.S.A.

Drawing by ERNEST W. BECK
Copyright 1957, by Zenith Radio Corporation

FIGURE 3

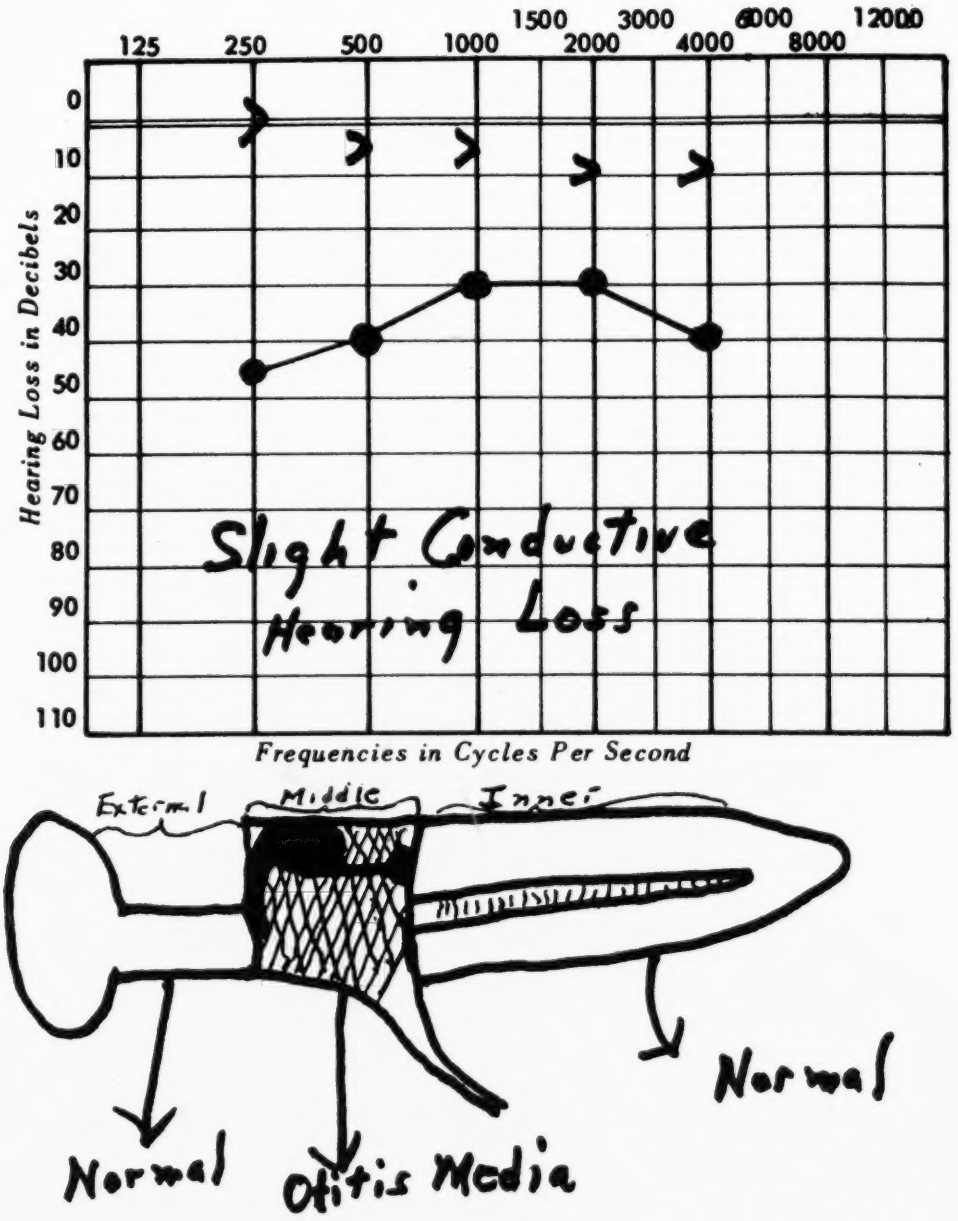
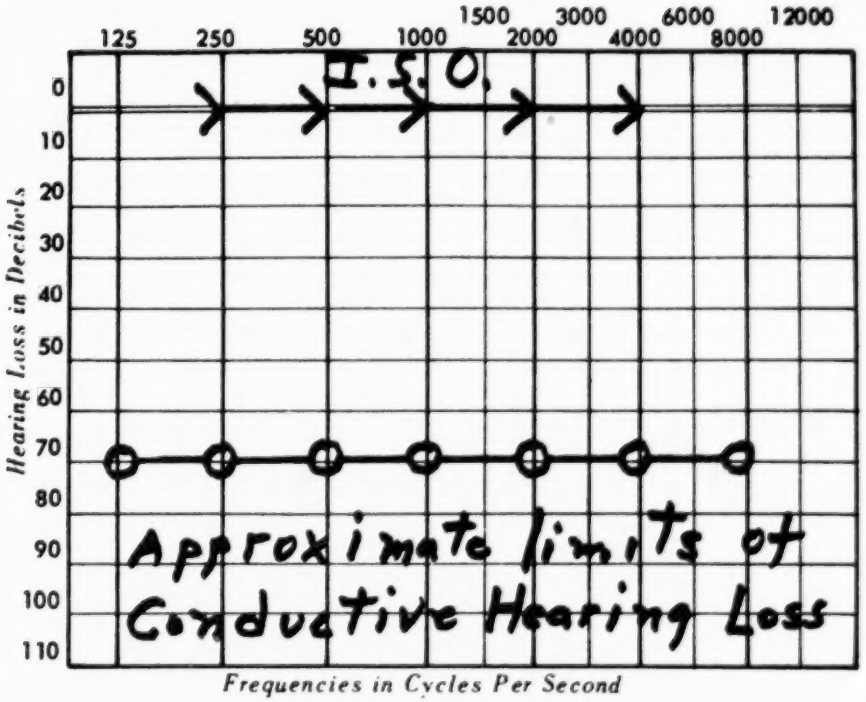

125
250
500
1000
1500
2000
3000
4000
6000
8000
12000
0
10
20
30
40
50
60
70
80
90
100
110
Hearing Loss in Decibels
Slight Conductive Hearing Loss
Frequencies in Cycles Per Second
External
Middle
Inner
Normal
Normal
Otitis Media

FIGURE 4


125
250
500
1000
1500
2000
3000
4000
6000
8000
12000
H.S.O.
0
10
20
30
40
50
60
70
80
90
100
110
Hearing Loss in Decibels
Approximate limits of Conductive Hearing Loss
Frequencies in Cycles Per Second

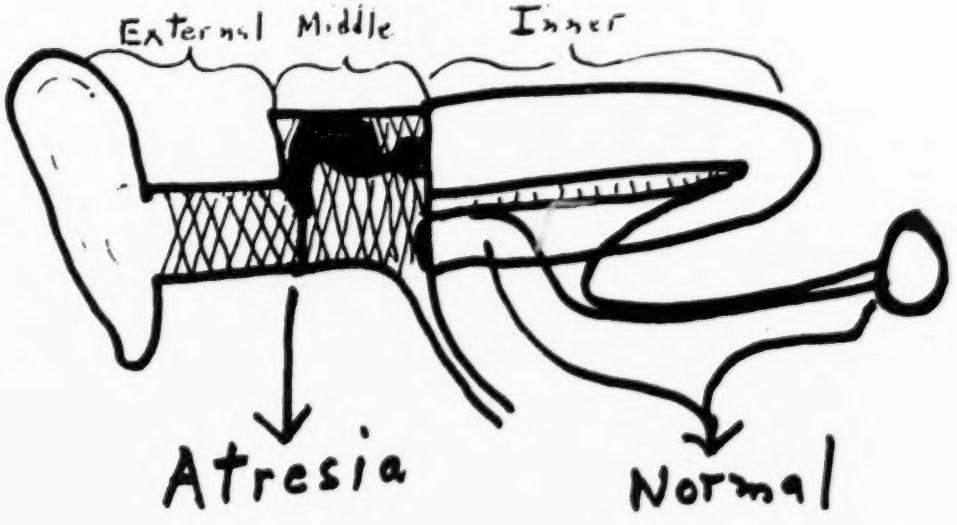
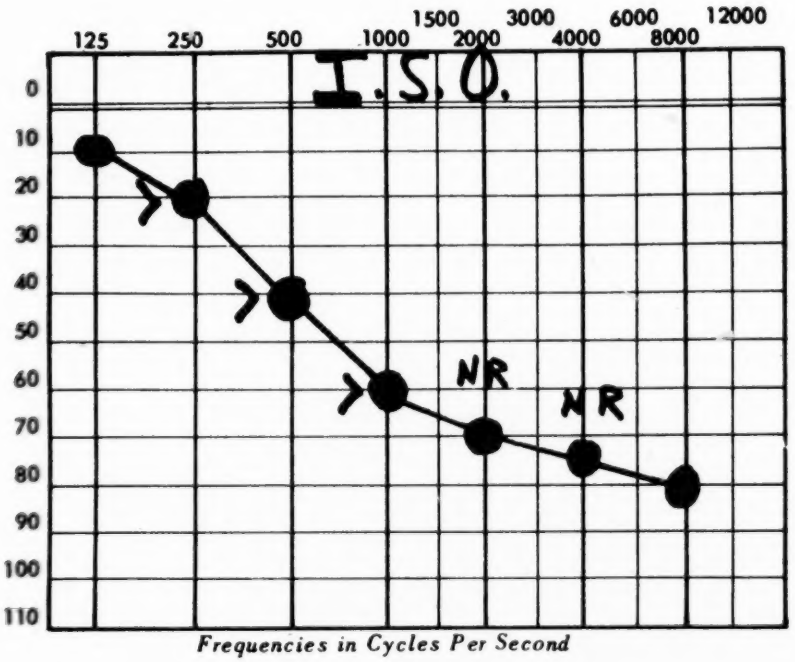

External
Middle
Inner
Atresia
Normal

FIGURE 5


125
250
500
1000
1500
2000
3000
4000
6000
8000
12000
I.S.O.
0
10
20
30
40
50
60
70
80
90
100
110
NR
NR
Frequencies in Cycles Per Second

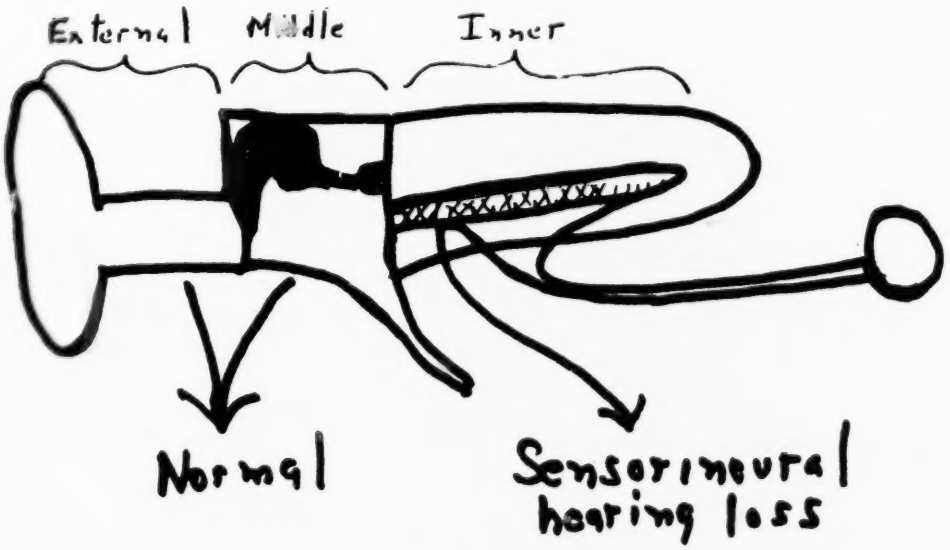

External
Middle
Inner
Normal
Sensorineural hearing loss

FIGURE 6

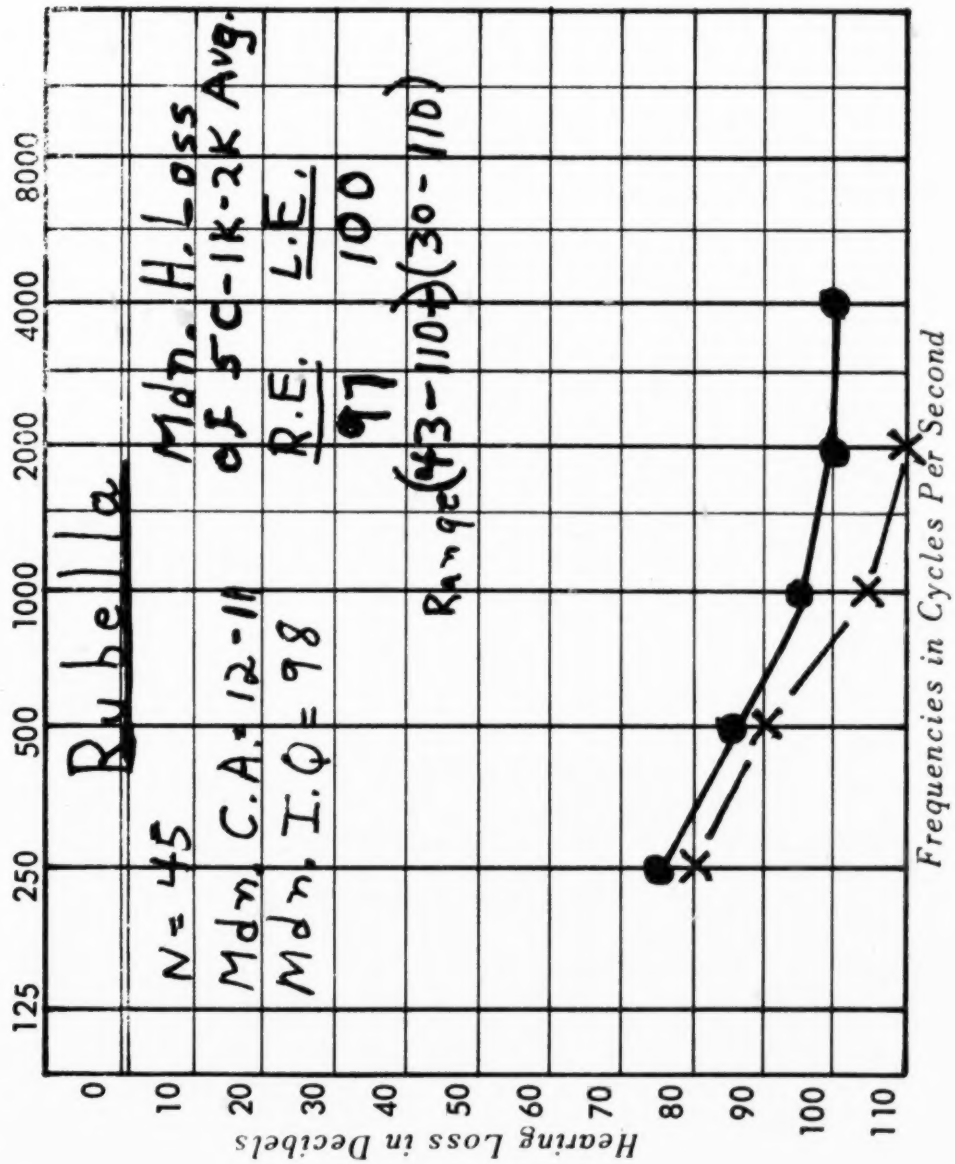
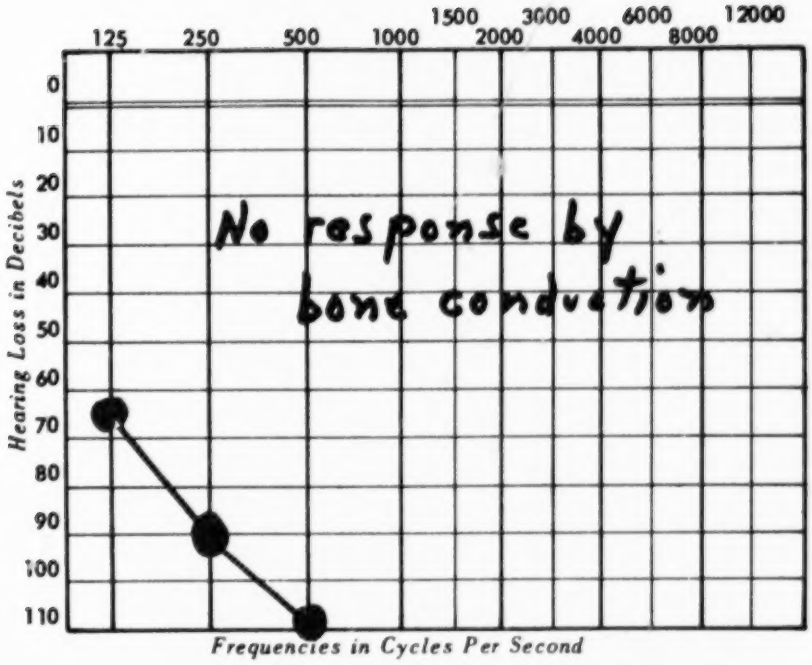

Rubella
N = 45
Mdn. C.A.: 12-11
Mdn. I.Q = 98
Mdn. H. Loss
of 500-1K-2K Avg.
R.E. L.E.
97 100
Range (43-110) (30-110)
125 250 500 1000 2000 4000 8000
0 10 20 30 40 50 60 70 80 90 100 110
Hearing Loss in Decibels
Frequencies in Cycles Per Second

FIGURE 7


125
250
500
1000
1500
2000
3000
4000
6000
8000
12000
0
10
20
30
40
50
60
70
80
90
100
110
Hearing Loss in Decibels
No response by bone conduction
Frequencies in Cycles Per Second

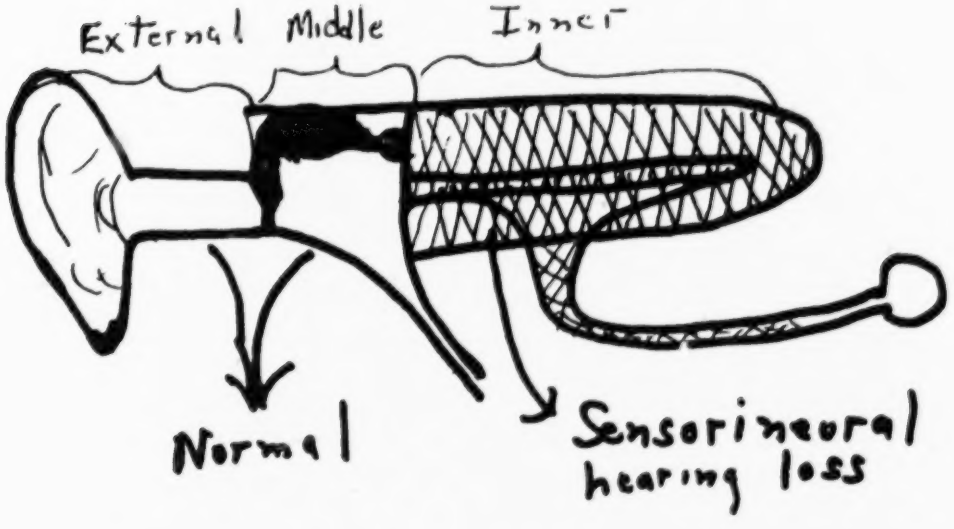

External
Middle
Inner
Normal
Sensorineural hearing loss

FIGURE F

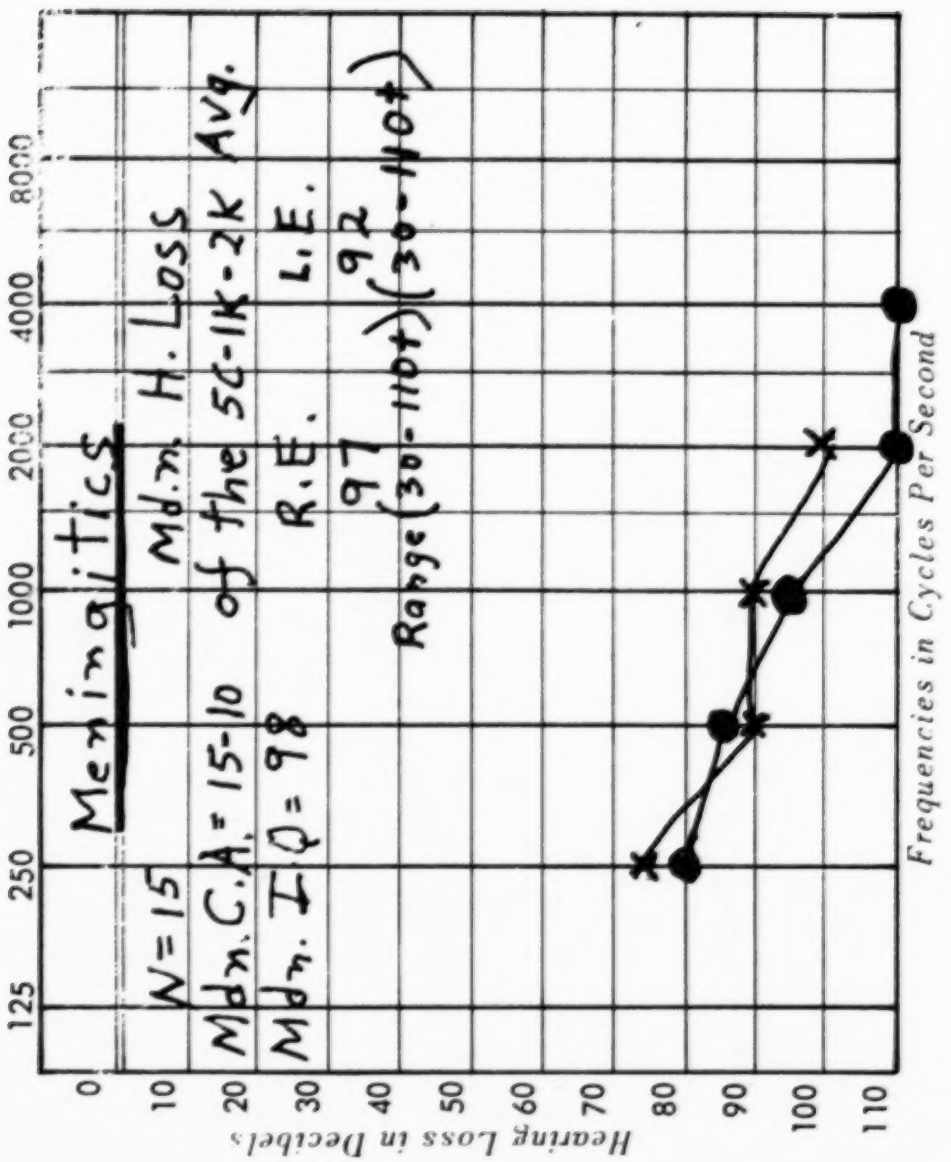

Meningitis
W = 15
Mdn. C.A. = 15-10
Mdn. I.Q. = 98
Mdn. H. Loss
of the 56-1K-2K Avg.
R.E. L.E.
97 92
Range (30-110+) (30-110+)
125 250 500 1000 2000 4000 8000
0 10 20 30 40 50 60 70 80 90 100 110
Hearing Loss in Decibels
Frequencies in Cycles Per Second

FIGURE 9

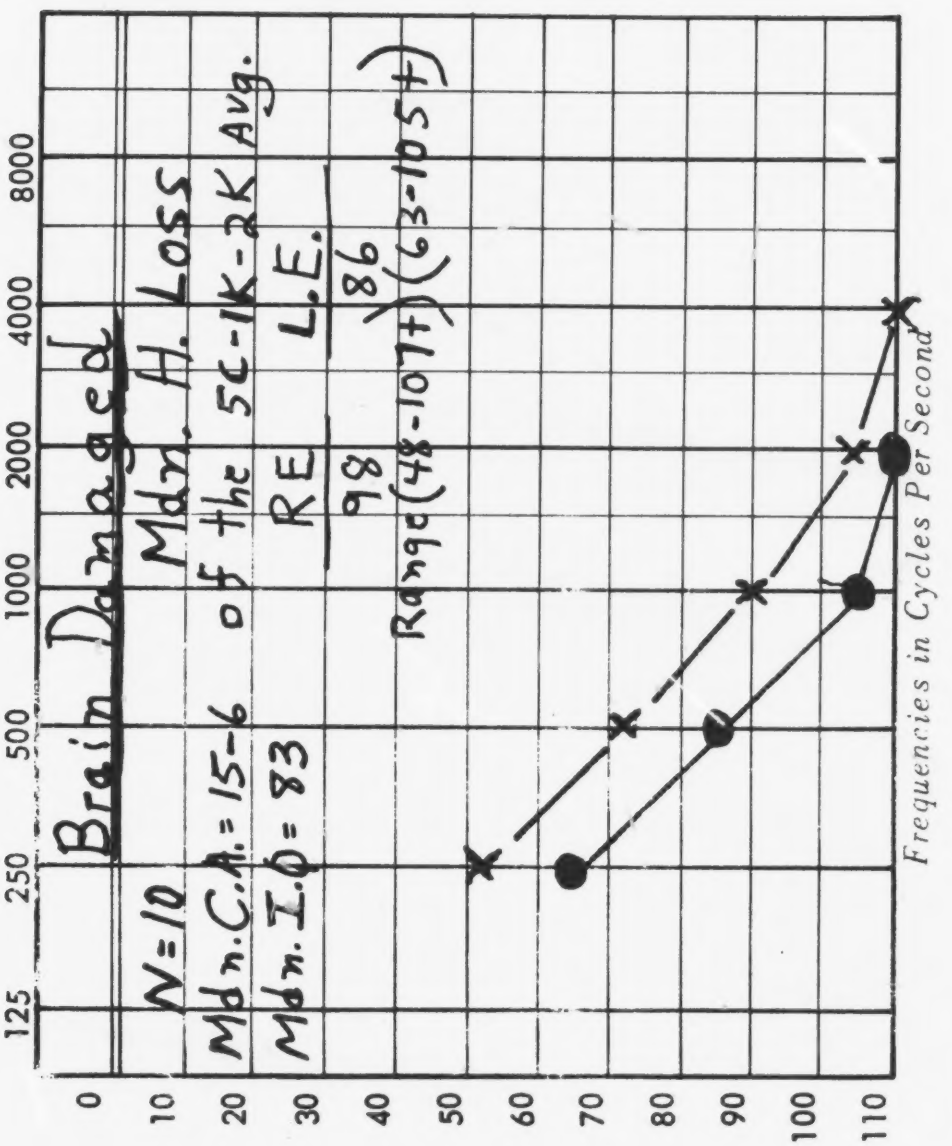

Brain Damaged
Mdn. H. Loss
of the 5C-1K-2K Avg.
N=10
Mdn. C.A. = 15-6
Mdn. I.Q = 83
RE L.E.
98 86
Ranged (48-107+) (63-105+)
125 250 500 1000 2000 4000 8000
0 10 20 30 40 50 60 70 80 90 100 110
Frequencies in Cycles Per Second

FIGURE 10

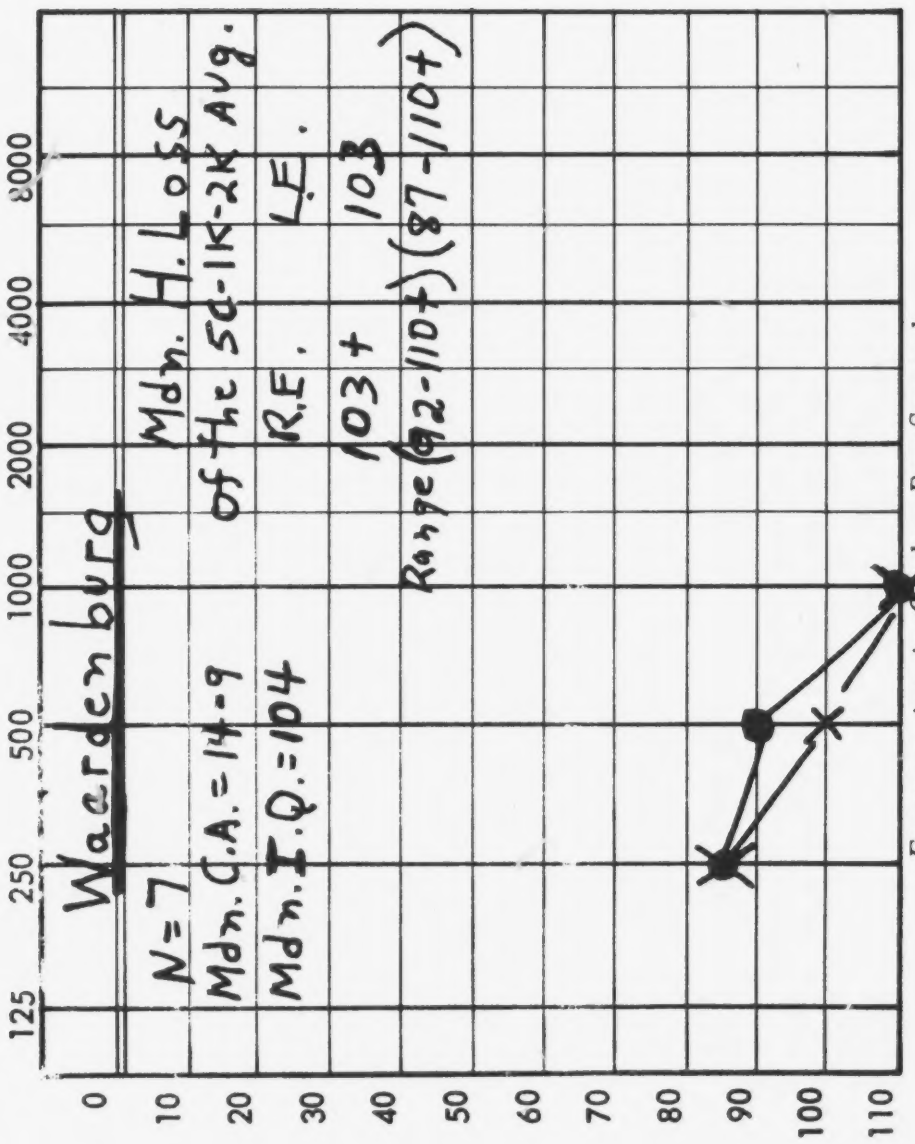
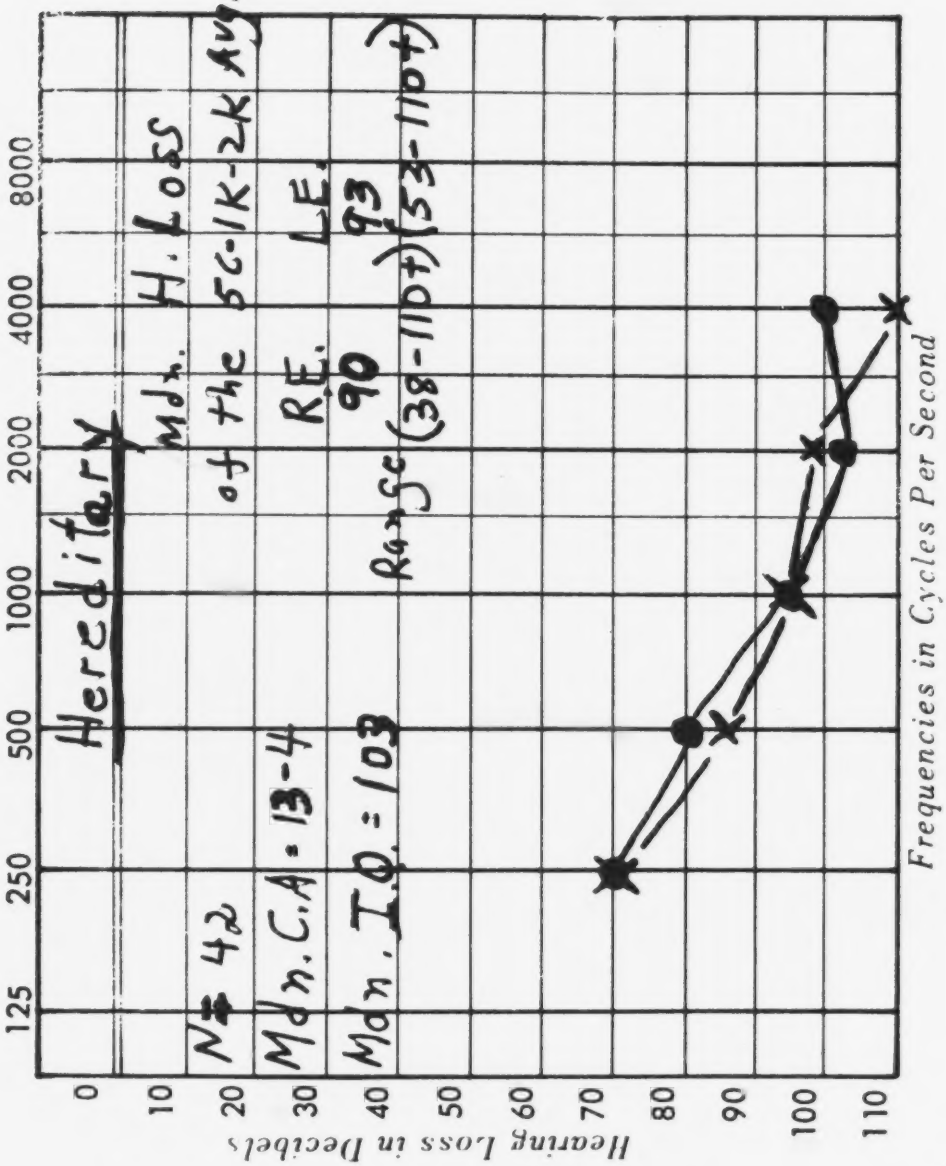

Waarden burg
N=7
Mdn. C.A.=14-9
Mdn. I.Q.=104
Mdn. H.Loss
of Hz 512-1K-2K Avg.
R.E.
L.E.
103+
103
Range (92-110+) (87-110+)
125
250
500
1000
2000
4000
8000
0
10
20
30
40
50
60
70
80
90
100
110
Frequencies in Cycles Per Second

FIGURE 11


Hereditary
Mdn. H. Loss
of the 5c-1K-2K Avg.
N = 42
Mdn. C.A. = 13-4
Mdn. I.Q. = 103
R.E. LE.
90 93
Range (38-110+) (53-110+)
125 250 500 1000 2000 4000 8000
0 10 20 30 40 50 60 70 80 90 100 110
Hearing Loss in Decibels
Frequencies in Cycles Per Second

THE EDUCATOR'S ASSESSMENT OF VISUAL FUNCTIONING

Ferne Root Roberts

Coordination of medical diagnostic information and educational information about a child's visual status is a simple concept. Unfortunately, it has been sounding like a simple concept for more years than some of us would care to count. The facts that this National Seminar is focusing on coordination of medical and educational information, that many children across the country are placed in Special Education settings on the basis of a single medical report of distance visual acuity, and that educational personnel in some schools do not have access to medical records, all indicate that though the concept sounds simple, implementation is extremely complex.

If utilization of medical information about visual status is not yet generally satisfactory in programs for visually handicapped children, is there reason for expecting people who work with multiply handicapped children to resolve the problem? Yes, I think so! And here are some of the reasons:

The field of Special Education is going through a period of very rapid change. Gardner has called this kind of activity "self renewal"; Hoffer describes change as an ordeal and most of us would agree with Toffler that we are in states of "future shock." In our own personal terms, we may be saying that we have difficulty digesting so many new ideas so fast and that, having digested an idea, we have such limited opportunity to acquire the new skills that new concepts demand. Or--we may not be saying anything at all about all this confusion, but find ourselves clinging more tenaciously to the ideas and skills we have. If this latter condition is true for any sizable number of those of us who are concerned with deaf-blind children and their families, then a healthy first step is to admit that our anxiety levels are running high, that we recognize this as a universal reaction to drastic change, but that we are ready to take the second step. If most of the people engaged in a field which is in rapid evolution do not participate in the evaluation of new ideas, techniques, and outcomes, the result is likely to be revolution rather than evolution. And, sadly, the voices of experience are lost in the wind.

Some of the emerging philosophies and techniques which have particular potential influence on our attitudes and practices with regard to the visual functioning of multiply handicapped children include:

1. Techniques such as behavior modification, precision teaching, prescriptive teaching, diagnostic teaching, directive teaching, which focus on the immediate, functional behavior of the child and on the modification of variables which will enable the child to change his behavior -- to learn. Techniques for contingency management, classroom

engineering, and provision of a prosthetic environment emphasize the systematic control of variables in the child's learning environment.

2. Educational assessment which pinpoints strengths and weaknesses and is a continuous component of the teaching-learning process. This type of assessment emphasizes a spiral of learning -- not a closed circle. A closed circle approach enables a teacher or parent to say, "There, he has learned that"; a spiral approach enables the adult to ask, "Has he learned this? What is the next step?"

3. Individualized instruction, which is now feasible as a result of the phenomenal availability of materials, equipment, and information through networks of information and materials centers.

4. Emphasis on teacher competencies for specified Special Education tasks. Many universities are experimenting with competency-based training for their Special Education trainees and both universities and commercial companies are developing simulation and mini-teaching programs. The hope of success in this area lies in the belief that educational personnel must be able to say, "These are the things I can do to help visually handicapped children learn," rather than "I am licensed to teach visually handicapped children."

If we were to attempt to capture into one sentence the import of these ideas, it might read: Best learning occurs when we know the child's functioning abilities in the specific area of learning, when we know the exact steps in the sequence toward mastery of the task, when we know which methods and materials stimulate this child and when we know which teaching behaviors will ensure success. Stated in those terms, that sentence sounds pretty much like others we have been saying or reading for several decades. However, a difference is implied -- and that difference lies in the specificity of our understandings and strategies!

It is important at this point, before we move on to a practical example of the effects of the current trends upon our understanding of visual functioning, to examine some of the implications and assumptions of our topic. What does "Coordination of Diagnostic and Educational Information" imply?

One of the most obvious implications is that there are two sources of information about the vision of deaf-blind children: Medical or optometric and educational. Secondly, there is an implication that there is value in merging and integrating information from these two sources. I will buy both of these concepts and they will keep us busy for the rest of the hour, so we need look no further.

Ophthalmologists and optometrists are accustomed to the fact that their examination and

treatment reports will be requested by schools and agencies as guides for provision of services to visually handicapped persons. In fact, as many of you will recall from personal experience, medical reports often in the past served as the sole basis for the placement of visually handicapped children in special programs and as a primary basis for determination of mode of reading. When medical personnel discovered that use of residual vision by visually handicapped children does not harm the eyes or reduce that vision, the gate was truly opened for the participation of educational personnel in the assessment of visual functioning and recommendation of certain educational procedures. Although there have been some notable examples in which the gate has been opened wide, the importance of visual information from parents and teachers has by no means been universally grasped by the special education community. During the past two decades, the chief thrust toward the schools' use of medical diagnostic information has been in the direction of training the teacher to understand and integrate the ophthalmologist's or optometrist's findings about the eyes and vision. Certainly it is crucial that at least one person in every educational program for visually handicapped children have the competence to read, understand, and translate into practical operation the eye specialists' reports and recommendations. However, if we stop there, both the eye specialists and the educators are being denied valuable information.

If we are serious about coordination of information, the following are minimal committments:

1. At least one qualified educator will have the competence to read, understand, and integrate eye and vision report information into day-to-day educational procedures.
2. At least one qualified educator or pupil personnel staff member will have the competence and responsibility for obtaining further information from the child's or a consulting eye specialist.
3. All teachers will systematically write questions and comments about the implications of eye physiology and diseases, which can be passed along to eye specialists as guides to the types of information desired. These questions might be requests for further information about a child's reaction to light, or a measure of near vision, or instructions regarding use of a low vision aid.
4. All teachers will be ready to write a report of the child's visual functioning in the educational setting which can be forwarded to eye specialists who are interested in their patients' day-to-day visual status. For example, a report from a teacher that a child can fixate on an object of a certain size and color at a certain distance for two minutes may tell an eye specialist that the child is ready for more detailed examination procedures.

Coordination works in two directions. We educators are fond of saying that ophthalmologists are so busy that we cannot bother them with questions or comments. I am not so sure of what ophthalmologists say about educators -- and that may be just as well. It has been my experience, however, that succinct requests for information or explanations about a child's eyes or vision meet with at least a courteous response and sometimes with enthusiasm because someone else is interested in the specialist's patient. Sometimes, a key to successful communication is a brief discussion with the specialist's receptionist or nurse. She can indicate whether it is preferable that requests be written and mailed to the office or that they be given to her by telephone and relayed to the specialist or that the caller leave a telephone number which the specialist can call between patients.

In addition to receiving and utilizing information from eye specialists, educators must have competencies as generators, users, and transmitters of information about visual functioning. Despite the work of Dr. Natalie Barraga and others who replicated her study, and the series of training institutes held in all parts of the country in cooperation with the Bureau of Education for the Handicapped of the Office of Education, there is still relatively limited systematic training for these competencies. It has been recognized for many years, and it hardly needs repeating, that the type and extent of visual impairment are not predictors of visual efficiency or that a child with a visual impairment is not equally handicapped in various aspects of his total environment or in various learning tasks. In other words, an eye impairment may be permanent and constant, but visual efficiency and performance are not constant, and both may be affected by training and by control of the learning or working environment.

Those of you who are accustomed to preparing educational objectives and charting child performance on priority tasks can predict the next steps, and some of you have already made significant advances in the direction of systematic assessment of visual functioning of children.

In order to assess functional levels for all types of behavior, including visual behavior, three comprehensive categories of activity must be set in on-going motion:

1. Educational assessment of children
2. Analysis of learning tasks
3. Controlled intervention

Educational assessment of children is the easiest and still the hardest of these categories of activities to think about creatively and productively. This seems to be true because we have preconceptions about the meaning and extent of educational assessment. Achievement testing or the weekly spelling list are valuable components of educational assessments, but they cannot serve as stereotypes. In work with deaf-blind and other multiply handicapped children, all areas of

behavior must be assessed and strengths and weaknesses pinpointed. And not the least of these behaviors which must be assessed are those of "seeing" and "looking." I am making the assumption here that almost all of the children in the Regional Centers programs have at least light perception and that most of them have potentially useful residual vision.

The essentials of educational assessment include a systematic, continuous program of formal and informal evaluation and a bank of information about developmental levels. Since so few young multiply handicapped children respond to formal testing or are fairly assessed by the standardized norms, this area of Special Education requires a high degree of time and creativity for the development of useful observation and assessment systems, scales, and inventories. For this reason, the importance of a deep understanding of developmental levels cannot be overemphasized. For example, think how easy it is to expect a child to copy a square shape before you are certain that he can copy a circle. It is equally easy to assume that he does not have enough vision to see the square, when the problem may lie with the fact that he has not yet reached the developmental level at which copying a square would be expected. Let me hasten to say, however, that very few of us have full developmental level information in our heads -- the goal is to get it at our fingertips so that it can be looked up. It is important to say also that everyone who carries out child observation and assessment activities risks mistakes in the sequence of presentation of tasks. So long as the goal of assessment is the pinpointing of strengths and weaknesses for use for instruction, these risks are worth taking. The only time the risks are bankrupting is when the child's responses are judged to be right or wrong and his worth as a person is on the scale. Educational assessment is not a witch hunt for "good" and "bad" kids -- it is a constant search for what and how the child can learn.

For those of you who may be initiating systematic child observation and assessment activities, the following reference may be useful: Establishing a Behavior Observation System: A Self-Instructional Program, by Gabriel Della Piana, Bureau of Educational Research, University of Utah, Salt Lake City. This is an easy-to-use manual which is not related to any specific educational philosophy or technique, which may be adapted for use in a variety of educational settings. Conditions for observations, types of observations, and tabulating observations are included in the self-instruction sections of this document.

The second step toward understanding the functioning visual levels of multiply handicapped children is an analysis of learning tasks. If we accept the fact that various learning or work tasks require various levels of visual acuity and efficiency, then it is obvious that the tasks must be analysed and stated in sequence. For example, each of the sequential steps involved in a child's going to the sink to wash his hands, beginning with the recognition that his hands are

dirty and ending with his tossing the paper towel into a waste basket, may require a different use of vision. He can bring his hands close to his eyes and he may be in good light when he is at his table; however, he may not be able to see the sink from where he sits, and it may be in a darker part of the room. The towels may be the same color as the walls, and there may be a step-stool between him and the waste basket. Most certainly, this sequence of hand washing tasks entails quite different visual demands from a sequence of tasks involving matching color designs on a peg-board with half-inch pegs. Thus, evidently we are not seeking the visual functioning level for each child -- he has various functioning levels for various tasks in various physical and emotional environments. In reality, aren't we seeking for ourselves the competencies which will enable us to assess child behavior and analyze the visual tasks in each child's learning program so that we can ensure his success?

If so, then the third aspect of the educational spiral becomes possible -- controlled intervention. Up to this phase, the educational personnel may have been using inventories, observations, techniques, and materials quite experimentally, or diagnostically, if you will. However, controlled intervention carries with it the imperative that content, materials, physical environment, teaching activities, time schedule, and measures of progress be outlined in detail. And it is essential that the format for measures of progress include criteria for observation of visual behavior. If certain materials and techniques elicit sustained visual performance and allow the child to successfully complete assigned tasks, the teacher has valuable information about her own competencies and about the child's visual potential for subsequent tasks. If failure to complete assigned tasks is the result of the child's inability to respond visually to the materials, the teacher is aware of need to modify tasks, methods, and materials.

Incidentally, from time to time a child's priority learning task may be increased visual efficiency. No matter how much or how little residual vision a child may have, the efficiency with which he uses that vision may be increased. Effective use of any degree of vision can be learned at appropriate developmental levels just as other effective behaviors can be taught. Again, I would refer you to Dr. Barraga's materials.

You will recall that specificity is a distinguishing characteristic of the current trends in Special Education. The term "controlled intervention" certainly implies a high degree of detail and specificity. To those who are stepping into this area gingerly and feeling pretty uncertain about the competencies required, there must be words of encouragement and support. It is not possible to gather all of the information, materials, assessments, and strategies that might be needed for a "perfect" learning sequence. The teacher absolutely must make some assumptions and operate with them. However, if accurate records and measures of progress are maintained, it is

possible to work toward greater and greater accuracy in planning and implementing successful educational programs for multiply handicapped children. What have you lost if examination of a day's records indicates that a child could not perform a color-matching task? Nothing is lost unless this information is ignored. Instead of feeling inept for having given a child an impossible task, the teacher can use this failure to fill great gaps in information. Questions for exploration include: Under what circumstances of light, size of object, variety of colors, etc. can the child distinguish colors, if at all? After many diagnostic trials with various materials, the teacher can then ask, "What was wrong with the environment, task, material, or teaching activity during the child's original failure to match colors? Incidentally, it is often equally important to follow this procedure when the child successfully completes tasks. Why were these materials successful? What aspects of the physical environment enabled him to use the materials? What previous experiences made it possible for him to use visual clues to complete this task?

I sometimes wonder whether the most important qualification for work with multiply handicapped children is not a high tolerance for uncertainty or for risk-taking. We seldom know for sure that what we are doing is right. If, however, we adopt the "assess, analyze, intervene, assess, analyze, intervene" continuous spiral, then a few wrong hunches can be viewed as inevitable and as fodder for questions which will lead in fruitful directions.

An example from recent experience may help to make some of this discussion more practical. You will, at any rate, soon see that I learned more than the deaf-blind child or his teacher did from this brief encounter. On a visit to a program for deaf-blind children, I walked into a classroom where the first thing the teacher said was, "I don't know anything about George's vision. I need to know how much he can see." George, a nine-year-old boy, had just been referred to a small class in a school for deaf children from an institution where children received limited adult attention and were allowed to roam around a day-room at will. Five minutes of observation revealed that George darts from one child to another to see what each is doing, is especially anxious to "capture" any adult, and is eager to keep the adult's attention by leading him around and pointing to objects in the room. George sits at his own seat momentarily when led to it and pushed gently on the shoulders. If there is material on his desk, he picks it up and carries it with him to someone's desk where he may make a few scribbles with a pencil, but he leaves it behind when he goes to the next desk. Each time he approaches a person, he smiles, makes eye contact, and utters unintelligible sounds as if he is attempting to communicate. His principle means of communication is through gestures and he does this largely through imitation rather than by initiation of his own gestures.

From this brief and rather general observation, it is possible to make assumptions about

priority learning tasks for George. When the teacher said that her primary concern was a determination of how much useful vision George has, she was asked, "Useful vision for what task?" In response, the teacher said that getting George to sit in his seat for short periods was really a primary concern. If behavior modification techniques were to be used, and sitting in his seat were the selected task, we could have stopped here. This was not the plan in this setting. So the next question was, "What do you want George to do when he sits in his seat?" Since he is interested in using a pencil and can scribble on an 8x11 inch sheet of paper, a paper and pencil task was suggested by the teacher. At this point, I began a series of mistakes. In an effort to discover something about George's interest in paper and pencil and perhaps something about his visual functioning in such tasks, I drew a circle of half-inch diameter. He immediately copied the circle. He also creditably copied a similar-sized square. He did not reproduce a triangle, but instead drew another square. Returning to circles, I drew successively smaller and smaller ones. George drew imperfect but creditable circles until we were down to dots. In order to make the dot dark, I made a slight up and down movement with the pencil. George promptly made an up and down mark on the paper. And I suddenly realized that George had been imitating my hand gestures rather than visually examining and reproducing the forms. Now, this is perfectly useful information, but it is not what I thought I was getting. Obviously, if I were George's teacher, this would be the time to embark on a diagnostic teaching program to reach some useful notions about sizes, colors, and shapes of objects which hold this child's visual attention and for how long. In time, I might reach the very helpful conclusion that George will use a pencil at a distance of 12 inches to draw around a yellow cut-out circle of two-inch diameter, and will then trace the drawing with his right index finger moving from left to right. He will do this once and then leave his seat, but if I sit next to him, he will do it at least three times and has done it five times. His desk is on the side of the room away from the windows and the light is barely adequate for normal sight reading. Time does not permit the pursuit of plans for George through the task analysis and controlled intervention stages of the learning spiral. However, this very brief information about George offers an amazing array of ideas about ways to help George and an equally amazing array of useful questions. Insofar as visual functioning is concerned, the teacher's original question, we do know that George can observe and imitate gross motor and some fine motor gestures at normal social distances from children and adults. We also know that he uses vision as his primary initial social contact. And we discovered that in moderate light, at about 12 inches from his desk, George uses vision to trace a yellow circle of a certain size with an ordinary pencil, and that he can then see this tracing well enough to run his index finger along the line. One of the questions I would like to ask, of course, is what would the optimum lighting conditions be for a boy with George's eye condition? And there are many others

which depend primarily upon a series of assessment activities in the classroom.

To many of you, George may seem to be a fairly high-functioning child. For some of the children in your programs, visual assessment may consist of observation of duration of fixation on a visual stimulus. Your real search is for some object or activity which will command the child's visual attention even for a few seconds. It is exceedingly important to present visual stimuli which are within the child's developmental range. It is tempting to use objects which might appeal to a "normal" child of the same chronological age, i.e. a baby doll for a four-year-old. However, in assessing vision and in training for increased visual efficiency, developmental levels must be considered. Fixation is the earliest visual achievement. Stimuli which attract very young infants are moving objects, sharp contours, and strong light-dark contrast. The rate of change of stimuli is also important. Rapid change may produce startle reaction, while the same changes at slower rates may be interesting or acceptable. In recent studies conducted at Harvard University and reported by Jerome Kagan in the March, 1972 Scientific American, in an article titled "Do Infants Think?" there are indications that infants begin to acquire mental representations of events as early as the second month. It appears that infants pay more attention, therefore, to stimuli that differ moderately from those they usually encounter. As an example, children of 7-12 months were shown an orange cube on six or seven occasions. When they were then shown a smaller orange cube, they attended to it for extensive periods and vocalized extensively. However, when shown a yellow rippled cylinder, there was limited attention and vocalization. The discrepancy principle: Events that are moderately different from the infant's schema elicit longer spans of attention than either totally familiar or totally novel events.

In another visual discrepancy study cited, four-month-old infants responded similarly. This study involved measuring the amount of attention (eye fixation) given to an arrangement of geometrical objects. After baseline measurements were made in the laboratory, the infants were returned home with mobiles which were to be hung over their cribs for thirty minutes each day. Some of the infants had mobiles which were identical to the arrangements they had seen in the laboratory; others had mobiles which were slightly, moderately, and extremely different, and a control group had no mobiles. At the end of three weeks, changes in attention to the original mobile were measured. There was no change in attention to the original mobile for those infants who had not had a mobile at home. The smallest drop in attention was found among the infants whose home mobiles were moderately discrepant; the greatest drop in attention was found among children who had identical or quite similar mobiles. Extreme discrepancy also showed significant drops in attention.

While we cannot equate the experiences and expected behavior of normal infants and older preschool multiply handicapped children, these findings may have significance to those of us who are

interested in the developmental aspects of vision.

So where does this approach lead us? Does it help resolve the problems surrounding coordination of diagnostic and educational information about visual status of a child? I believe it does because it alters our perspective about visual status information -- visual functioning must be viewed as a developmental process rather than a static condition and visual functioning can be assessed only in terms of the environment of the child and the tasks he must perform within that environment. This, then, means that at any given time, the educator is prepared to give a few concrete examples of successful visual performance under specified conditions; he is certainly not prepared to give a broad, general statement which will stand in the records for years as a summary of visual functioning. Eye specialists can supply quite definitive information about certain eye conditions and can often make long-term predictions about the status of the eyes and the stability of visual acuity. Educational assessment of visual functioning does not easily fit into the medical model report style. Our joint task, then, is to develop meaningful ways of recording and reporting information about how children use vision at home and at school.

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"PIAGET AND BEYOND: A THEORETICAL MODEL
AND ITS
APPLICATION TO EDUCATIONAL PROGRAMMING"

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It has been over 50 years since Jean Piaget's experimental studies into the nature of intelligence first began to appear in the literature. Little time or attention was paid to him at that time or for some time to come. He was, as they say, "A man whose ideas were far before their time in the eyes of the world." The western psychological world was greatly entrenched in other issues than how intelligence developed in children; also, the great school of behavioral psychology was emerging in the United States. It provided a pragmatic approach, easily acceptable to the American people and defensible culturally.

Piaget identified himself as a genetic epistemologist, not really as a psychologist, and this identification made his philosophical framework somewhat less palatable to psychologists. Additionally, Piaget, for many years, identified that he was not concerned with pedagogical issues. He felt that any of his work was premature for use in the classroom. It was his belief that we needed far more knowledge and information about mental development and how it occurs in children before tampering with the educational process. Piaget's central interest was related to the resolution of philosophical issues by way of experimental study of the child than with advancing psychological theory or educational practice.

Today, Piaget's works are no longer in the hands of the theorists, researchers, and scholars. Today, we are concerned with how intelligence develops, how it can be nurtured, how environment is instrumental in the organization of intellect, and the effect of such development on the economy of the nation and the world. Out of this concern has emerged whole new concepts of organization of educational process and programs. The federal and state governments have developed extended and enriched educational experiences for pre-schoolers in the belief that by providing such early experiences, the effect will be greater intellectual development by maturity. Such planning, organization, and programming are evidence of the influence and force of Piagetian theory. Dècarie (1965), Corman and Escalone (1969), Sullivan (1967), Woodward (1961, 1972), Wachs and Uzgiris and others have been instrumental in providing this impetus to education by expanding Piaget's theories into education.

Today, we are concerned in learning theory with how the individual acquires knowledge of himself and his environment, and further, how this knowledge is used to change the environment. As Woodward has stated, "The main educational application of Piaget's work is that it offers a means of teaching subjects when children have the necessary concepts of understanding them."

(Woodward, 1962)

Piagetian theory concludes that behavior is invariant. That is, development proceeds in stages of definite sequences in which the organization of thinking (cognitive) processes is structured from the simple to complex in an orderly determined manner. The environment in which a child finds himself provides the stimulus for development.

The organization of sequential steps into a functional hierarchy suggests that a natural order must exist for capabilities to develop. Natural order does not carry with it the implication that development is genotypically predetermined. It is presumed, therefore, that the order is based upon continual interaction of the infant with his environment, and that the neuropsychological processes upon which intellect and motivation are based are hierarchical in nature, so that later developments presume earlier ones, (Ashurst, 1971). Experimental research ongoing at the University of Montreal in which Piaget's work is replicated and new studies to develop an ordinal scale of cognitive development based on the Piaget model, provide ample evidence in support of this approach and concept. (Pinard and Sharp, 1972)

Piaget's investigation of the nature of intelligence was perhaps the most singular instance of concern for analysis of the qualitative characteristics of the organization or structural framework of thinking processes. He, as a worker in the Binet laboratory in Paris, France, then under the leadership of Simon, was chiefly concerned with the concept of why and how cognition develops rather than the more prevalent concept of "PASS-FAIL" on tests of intelligence. He was at that time and presently, particularly concerned with the underlying strategies or programs the child has at his disposal when interacting with the environment (Schemas). He views intelligence developmentally as a process of growth evolving from birth to maturity. He has found fit to describe this process as stages of development wherein each stage of development is dependent upon the preceding stage of development. He has named these the sensory-motor stage, pre-operational stage, and operational stage. Within each stage are a number of substages, which constitutes a system of ordering as a result of schemas (brought about by the interaction with the environment), and serves as a mediating link between assimilation and accommodation.

Assimilation is simply the incorporation of the environment into present patterns of behavior. Accommodation is a process in which necessary adjustments are made to the demands of the external environment.

From the moment of birth, the infant must begin making accommodations to the environment. Oxygen must fill the lungs and be forced in and out of the lungs for survival. Adjustments to temperature changes also must be accommodated. Food must be taken in by a new method. The environment is alien, and the infant must interact with it, make accommodations to it, and develop

assimilatory processes for survival and growth within it. At the beginning, the infant's behavioral repertoire is totally motor, proprioceptive behavior. If the suck reflex is present, he responds to a nipple placed in the mouth and sucks his food. As the environment impinges upon the child in terms of hunger, thirst, temperature comfort, and discomfort, the child's awareness of mental imagery begins to process and storehouse information necessary for survival.

This is the beginning of the system of ordering. It is the forerunner of the concept of object permanence. As stated earlier, to the newborn, there is no meaning to the environment. Objects make no sense to infants other than to "eye-ball" them, but no attachment is made to them. They have no value nor do they serve any purpose in terms of need fulfillment; thus, they form no mental representation or imagery. At this stage of development, the child's behavior is determined to be reflexive and motor. By the end of the first month of life, adaptations to the environment are remarkable. Random at first, the actions are repeated and the redundancy produces desirable outcomes, of which the net effect is the beginning of habituation and perception brought about by the earlier experiences and the continuing differentiation of those experiences so that they are assimilated into a new repertoire of behaviors. The baby is now beginning to find satisfactions and is concerned with an environment beyond his own body. The young child at this stage of development is observed to have the rudimentary beginnings of what later is described as imitative behavior. Now it is simply for functional pleasure. (1st to 4th month.)

During the fourth to ninth month of life, behavior begins to portray some organization and relationships. The beginnings of repetitive actions and the consolidation of earlier acquired behaviors take shape and are acted upon more meaningfully in a coordinated fashion. Ends and means are still undifferentiated. Major concerns are with establishing contact with the environment, such as developing eye-hand coordination or using an object for the pleasurable sensation it creates. Objects are followed and attempts to find them are short-lived but evident. Imitative behavior is more meaningful and play activities are becoming evident as pleasurable for themselves.

From the ninth to the twelfth month, it might be said that the child is "getting it all together" and beginning to use earlier schemata in a manner which identifies that the child has some awareness and imagery of the constancy of objects. Exploration and exploitation of objects begins with attempts at developing imitation of models. Play for its own sake begins to take shape and ritualistic behaviors appear as a precursor of "symbolic games" to appear later (Piaget, 1952).

The fifth stage of development, between twelve and eighteen months, is characterized as "trying on new styles" or "variations on a theme." Here, the child experiments with his environment and the things in his environment. He attempts to approach and solve new problems. He

searches for new ways of using materials. Imitation and play are observed to be more systematized and ritualistic.

Stage six is the final stage of the sensori-motor period of development. Behavior during the eighteenth to twenty-fourth month is characterized by a growing awareness of relationships and associations. There is less trial and error behavior. The child now tends to rely on previous experiences which he has internalized and approaches problem-solving in a more assured fashion. He has started processing information via deduction and combination of mental processes. It is at this stage that a transition to patterns is observed in which language emerges and the thinking processes advance and, as Piaget (1962) states, "invention of new means" develops.

It is not to be assumed that "language" suddenly emerges. "Language" does not mean verbal expression or spoken language only. Language begins with the first beginnings of representation or mental imagery. It begins with the first interaction the infant has with the environment and continues to organize itself. Hermina Sinclair, at the University of Geneva (1970), in her study of infants, has this to say about the progress of intelligence:

> "Pre-verbal, sensory-motor intelligence progresses to where the child needs some kind of representation for further cognitive progress and where his cognitive structure makes such representations possible. Observational research shows that early symbolic behavior occurs only after objects have been endowed with certain physical and conventional properties and after certain kinds of creative organizational behavior have appeared. The beginnings of language can be studied as part of representational behavior and may show such object and subject-oriented quality in lexical and syntactic components."

This belief, of course, denies transformational grammar concepts or the concept that language is innate and divorced from any other capacities the child may have. Language is not autonomous. Language is a skill acquisition. Such acquisition can only be understood by understanding and acceptance of the concept of development; cognitive, affective, and social. This is not to say that the cognitive development model can explain or be directly applied to language acquisition. But, as Sinclair (1970) states, "it does mean that Genevan psycholinguists believe that the child's competence in producing and understanding speech proceeds basically according to Piagetian model of cognitive development: through complex interaction between the individual's inner structures and pre-structures and the objects and people around him, by integration of the new into the old, and the reconstruction of the old into ever more general and higher-level mental constructs."

To this point in my paper, I have traced the concept of sensori-motor, pre-verbal cognitive development in the child from birth to two years of age. I have identified that intellectual operations organize themselves in this period and that these operations do not have their base in

language. During this period of development, a system of "schemas" are formed which eventually sets the pattern for logical systems calling for abstract symbolic reasoning to occur. Mental imagery or representation is the catalyst for language and thought to develop. Most of these things have occurred without verbal expression. However, much language has occurred. This is observable in the increasing affective, social, and object behavior of the child; in his babblings and intonations he employes as he endeavors to imitate the sound-system of those around him.

I think no one denies the emphasis our society places upon the acquisition of a child's first word. Every professional discipline dealing with evaluation and assessment of children records the occurrence of the developmental milestones of motor and speech. Little, if any, attention is made of the non-verbal language which exudes from children who have not developed organized verbal expression other than to eventually label them aphasic or autistic rather than to set about organizing their language processing system. In essence, much symbolic function transpires which is not dependent upon verbal expression. Verbal expression is simply an added motoric function which transmits thinking processes more expediently. It is not essentially an indicator of cognitive development or function!

Verbal expression may occur totally. It may not occur at all. It may occur partially. The etiology for any one of these occurrences is varied. In some cases, it can be determined specifically; in others it is assumed. Unfortunately, when verbal expression does not occur at all, it is usually linked with pre-natal or peri-natal catastrophe or trauma and becomes part of the syndrome expectancy. The expectancy for "normal" cognitive development in such cases is poor at best because a condition is assumed to exist within the child. The net effect is that the child is ascribed as mentally retarded and the prophecy is fulfilled.

Until recently, the medical-clinical model prevailed as the authority to seal the fate of such children from birth to death. The empirical evidence has mounted to contra-indicate the continuing use of the medical-clinical model built on pure assumption or empirical studies of one case. The efforts of the Deaf-Blind Center Act in which empirical studies using educational models, setting these into practice, has produced overwhelming evidence of the naivetè of the medical-clinical model as the determiner of developmental expectancy of the maternal rubella child.

Other than Mary Woodward, who has studied severely subnormal children and adults, and myself, I have not found anyone who has set themselves the task of using Piaget constructs to study structures of development as they occur in population of children who lack normal cognitive development. We have been studying a population of children whose sensory input ranges from profound hearing loss and total blindness to children who are partially sighted and mildly deaf. Often, when using these terms, we tend to be lulled into a belief that hearing level is synonymous with audition and

sight, synonymous with vision. This is a totally invalid and unreliable assumption as anyone who has worked directly with these children will avow. Also, it is equally unrealistic to accept the notion that the lack of sensory input is the only factor interfering with normal development of these children.

A myriad of problems complicate the otherwise normal growth and development expectancy. Conditions, such as prematurity, with the variety of complications that often occur with prematurity, cardio-vascular defects, and cataracts that, when diagnosed, require surgical procedures, and hospitalizations in turn cause maternal separation, deprivation, and lack of infant stimulation that is not part of a normal mother-child relationship. Statements to parents by attending physicians and other professionals have contributed to development of negative attitudes toward the child. Lack of interest and concern, inadequate knowledge of the dimensions of the problems the epidemic of 1963-65 cast across this nation, unreadiness by the medical and educational community to cope with the fall-out effects of the epidemic resulted in nation-wide impotency. The net result has been a sterile, crippling, stagnating infancy and early childhood period of life.

During the first five years of life, life-preserving and health maintenance services had been provided. However, very, very few of the one hundred and fifty parents interviewed during the evaluation and assessment of their children, under the auspices of the Title I federal grant to the Diagnostic School for Neurologically Handicapped Children, Southern California, reported any kind of assistance, support, or counseling regarding techniques, methods, or programming of how to stimulate and organize the developmental behavior of their children. Often, they reported that they were told to place the child out of the home, not to become attached to the child, not to waste any time on the child, to keep the child in a crib. In essence, they were cast aside by the only significant human beings in their lives -- the only persons who could have helped them develop more appropriately than they have.

At five and six years of age, when we first saw these children, they evidenced every bit of the expectancy the parents had been counseled to provide. We were presented with children who showed development within the sensori-motor level stages for the most part. Because of little or no stimulation of an integrated nature, they lacked the opportunities for experiences basic to language organization to occur. Their behavior was purposeless and random. They developed autistic and self-stimulatory activities. Their behavior was, for the most part, at the reflexive or proprioceptive level of development. The behavior was purposeless. Inappropriate giving or denial of love disallowed the development of affective and social responsivity. To assess these children on the basis of their chronological age on a body of standardized tests and measures orgnized on a "pass-fail," quantitative basis, would be no more than to accept the prophecy and labels handed out

for these children much earlier in their lives. To replicate this process would serve no purpose. Therefore, it was determined that diagnostic assessments should be made, using a developmental model which could have implications for and application to the organization of a pre-linguistic educational program. The Piaget model of cognitive development seemed to us a valid approach for our study.

Our first premise in establishing an approach to diagnostic assessment of deaf-blind children was our belief that development is a dynamic process. We further believed that for development to occur, whether it be a one-celled protozoa or the exceedingly complex human being, growth and development does not occur in a capricious fashion, but in a logical, sequential order. We also believed that those experiences which held the greatest meaning and served the most useful purpose for the organism could be utilized as baseline data relative to ascertaining a child's developmental level. From this data, we could organize and structure sequentially ordered tasks to further the child's development. Bruner (1961) has said ". . . . .to operate efficiently in the environment, an organism must have a model of the environment." We believed that from the baseline data, we could develop a model of the environment, and by providing specific instruction and making that learning specific from the learner's point of view as Kamii (1970) has suggested, we could cause learning to occur.

We futther believed that we must look at the structure and function of cognitive development. We were concerned with how the child organized his behavior, not whether he did or did not succeed. The usual tests of intelligence are not concerned with evolutional patterns, but only with the "genetic" character of intelligence. As Pinard (1964) has stated: "Now the operative theory of intelligence as formulated by Piaget, can be nicely applied to illuminate changes of mental structures or modes of thought proper to the child's specific age, and to show the necessary sequence of mental structures which succeed each other in a precise order following a definite evolutionary principle."

Our final premise embodied the concept that for development to occur, the behavior must be purposeful, leading to new behaviors, integrating the old behaviors, and creating a repertoire of expanding knowledge.

Therefore, the diagnostic assessment procedures sought to examine the presenting behavior by several methods employing a variety of disciplines including pediatric neurology, psychology, audiology, language pathology, and educational clinical appraisal.

Initially, a history of the child's growth and development was taken from the parent. The parent was asked to relate the behaviors of the child. Usually, it was found that the parent described behavior in terms of a "pass-fail" concept, rather than in terms of intact, integrated

behavior that had purpose.

Following the history taking, the child was observed to determine how and to what degree he used the environment. This clinical observation was then followed by formal examinations. Essentially, the pediatric-neurologic examination provided valuable information as to the physiological developmental level and the capacity for function. It was essential to know whether the muscular tonus observed was related to a central nervous system defect or simply the result of lack of usage and stimulation. It was essential to know the condition of the eyes' responsiveness to light and accommodation and ability to track. It was important to know whether neurological reflexes were intact or not, whether palmer and pince grasp were operating. It was important to know whether the oral and tongue musculature were operating normally. From these examinations, it was possible to know whether a child did or did not perform behaviors within his developmental expectancy because of physiological and/or neurological deficits or simply because he had not had the opportunities or experiences for such development to appear.

It was necessary to learn whether the child responded to sound, the kinds of sounds including frequency, intensity, pitch, and loudness; whether instrumentation had been attempted, how long, and its effect. Formal and informal observation and testing was the next step to determine if and how effectively the child responded to sound stimulation purposefully. Examinations were carried out in a calibrated sound field, testing suites, classrooms, hallways, and dining room, with and without instrumentation and amplification. Attempts to gain responses were also tried with an infant audiometer when the child was asleep, in those cases in which no responses were forthcoming by other testing attempts.

Use of sight and central vision were examined by use of a black-out room in which light was used as a reinforcement for performance. A colored light-sound screen was employed in which a different colored light pattern for differing sound frequencies would appear when the child vocalized. We found that auto-ocular stimulation could be extinguished and be replaced by purposeful behavior such as vocalization or reaching out for an object from which sound or light was emitted. A child who otherwise chose to remain unattached from the environment, lying on a rug, poking his fingers at or in his eyes to produce self-satisfying phosgenes, could be trained to track to light and light and sound combinations.

Every opportunity was seized upon to evaluate the child's reaction to light stimulus, the manipulation of light, manipulation of objects obstructing light sources, reaction to mirror image, vocalization accompanying light stimulus, reaction to gross sound, the projective use of sound, reaction to vibration by use of hands and other parts of the body (cheek, head, etc.). It was necessary to determine whether or not such reactions observed were transient or were reproducible by the child

on demand. In other words, we were interested not only in whether the child did or did not produce a certain response to a given stimulus, but whether or not the observed behavior was part of a structure underlying other behaviors basic to continued development, or whether it was a random, transient, purposeless act.

Similarly, we observed the child and the relationships he made generally to the environments provided in the various examining rooms, dormitory,hallways, classroom, etc. Behavior, ranging from absolute unawareness to overt exploration of the environment, was observed and charted.

Each child was observed and evaluated as to his orientation toward objects. Research at Ypsilantiz High/Scope project and Children's Center at Syracuse point to the fact that it is extremely essential for infants and young children to have contact with and manipulation of objects for cognitive development to occur.

Our procedures were organized to assess the child's ability to relate to and use objects. An ordinal scale was developed, based upon developmental stages suggested by Piaget. This scale covered the entire sensori-motor period of development. The tasks ranged from simple awareness of an object to the level of insightful use of the object or material. In this manner, we were able to observe and chart performance at each stage of development. We were able to determine the degree of integrity of cognitive function in terms of the child's utilization of and involvement in the environment through object utilization.

Affectivity, or the ability of the individual to develop social responsivity and interaction to his environment is a basic characteristic of development. The lack of capacity of the individual to develop affective behavior is considered abnormal in all cultures. When a lack of affective behavior is observed, it is labelled as a psychosis and often, in children, is termed autism. Autistic behavior is not abnormal when it occurs in the normal time sequence of development and when such behavior gives way to new patterns of behavior which require interaction with the environment.

To measure affectivity, an ordinal scale of social orientation was constructed which served to measure observable behavior ranging from indifference in behavior between objects and persons to competitive play. At this point, it is significant to say that, to a large degree, the children who had not developed beyond the sensori-motor level showed many autistic and autistoid-like behaviors. It was not because of pathological cortex insults that they functioned as they did, but because of a lack of infant stimulation, lack of sensory-input from the environment, hospitalizations, surgical procedures, etc. that these children had not advanced beyond the autistic stage of development. This was verified by actual changes in social orientation when these children were placed in prelinguistic educational programs which had been organized on a basis of sequentially developed tasks related to the developmental levels of the child. Pre-and post-test data, including video tape studies of six children who were in the residential program at the Diagnostic School for

Neurologically Handicapped Children, Southern California, as well as reports from classroom teachers on those children assessed at DSNHC,SC, and for whom sequentially developed task programs were employed in community school programs, provides empirical evidence and support for this concept.

In summary, from our studies we have confirmed that development of all human beings occurs in an orderly manner, that stage-dependent theory of cognitive development provides a meaningful approach to assessment of the organization of behavior, that from such an approach to assessment, understandings occur which provide for the development of training and education of children regardless of their deficits, that the most potent factor to cognitive development is time; the earlier that interventions are organized and provided, the greater the opportunity for development to occur, that the organization of an information processing system is an imperative; until a language system is organized and functioning, behavior will remain autistic, random, and purposeless.

The children of the 1963-65 rubella epidemic, unfortunately, were identified and assessed too late with too little to effectively change their lives as much as we now know we could have had we begun our work at the time the mother contracted rubella. However, scientific advancement has occurred. From the 1963-65 rubella epidemic, as with the poliomyelitis epidemic, we have developed new preventions and treatments. We have gained new knowledge and understanding of how to assess children who manifest other kinds of defects which will interfere with expected development of learning behaviors. We know that unless interventions are contrived and organized to assist the child with handicapping conditions to overcome the known delay in development, which undeniably will occur, we can expect behaviors similar to those observed in the deaf-blind child. For those deaf-blind children not receiving any organized community program, it is most essential that their parents or the adults responsible be provided guidance and training in infant and child development processes. Such training would enable them to deal more understandingly with their children and, hopefully, force development to occur which would allow these children a more meaningful, less dependent life. In turn, this procedure would serve to enhance the prospect for greater development to occur once an organized training and education program to meet their needs becomes available in the community.

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"THE APPLICATION OF THE PIAGET MODEL

TO A SEQUENTIAL DEVELOPMENTAL TASK CURRICULUM FOR

DEAF-BLIND CHILDREN"

Mrs. Ann Bisno

The development and implementation of an instructional program for multihandicapped deaf-blind children is one which, until recently, received little attention from educators. Focus on such severely involved youngsters has traditionally fallen upon their medical anamolies and needs. The vast majority of professionals involved have regarded them as less than trainable and so concerns for them were predominantly custodial. It is in large measure due to the development of the skills in medical science in saving lives and to the researches of social science in questioning the state institution "solution" that the educational system is attempting to provide programming and services.

The research and program developed at the DSNHC,SC., was an attempt to look at these children as children, disregarding previously limiting classifactory labels, and to refine, adapt, and develop assessment procedures which would have meaningful reference for curriculum development and educational remediation.

Piaget's theoretical construct has proved useful in serving both as a broad unifying conceptual framework, but also in evolving methodological applications in actual classroom practice.

1. Piaget's concerns with the development of the human child are mainly with intelligence, with cognition, and intellectual processes. One of Piaget's definitions of intelligence is that it is an instance of adaptation which allows the individual to interact with his environment. The attainment of increasingly effective intellectual structures resulting in more effective relations to environmental interactions, is the goal of the educative process. This delineates the area of concern.

2. Piaget regards the growth of intellect as sequential and hierarchical. Each succeeding stage must be firmly built on the foundation of the prior stage. No true development of intelligence can take place without the prerequisites of preceding levels.

3. Each level of development is characterized by a series of psychological structures. These structures, in a sense, exhibit a balance between the individual's mental actions and his environment and are termed equilibrium by Piaget. It becomes the responsibility of the educator to be knowledgeable of the sequences of development and provide, as I interpret Piaget, appropriate interventions to facilitate the growth process, either to promote equilibrium or disturb it.

4. For Piaget, true development is dependent on the interaction between the organism and its environment. Here, the emphases are on the dynamics of the interaction. The individual is viewed as being acted upon by his tendency to change in response to environmental demands, i.e., the process of accommodation and acting on his tendency to deal with events in terms of his current structures, i.e., the process of assimilation. Thus, two essential principles of functioning, which are invariant, demand consideration from the educator -- the nature of the environment and the level of the subject.

5. Development may be horizontal as well as vertical. Structures which represent the individual's functional level in the cognitive sequence may be employed in any number of areas of environmental interactions. Achievement of one stage in one area does not insure automatic transfers in another area. It is, therefore, possible to have overlapping of structures.

6. A basic theme running through all of Piaget's thinking on intellectual growth is that of integration. He makes frequent references to the integration of reflexes resulting in habits, to the integration of schemas (organized patterns of behavior), to the integration of signifiers with experience, to the integration of symbols with symbols, and to the manipulation and integration of two or three or more concepts simultaneously. Reactions of increasing multiplicity and complexity are indications of behavior becoming increasingly integrated, thereby indicating the presence of higher level intellectual structures.

7. Noted in the progressive evolution of human intelligence, is the characteristic Piaget terms decentration. It is most simply defined as the distancing of the individual's response from his own egocentric organismic bound assimulative tendencies to less immediate, less stimulus-bound processes. It involves the increased dominance of the accommodative function in adaptation.

8. Piaget's approach to language is basically that of a tool to intellect, founded upon a base of experience, but also structuring it, defining it, assisting in organization of data, involving increasing abstractions and distancing from the direct experience, and becoming the instruments in later intellectual stages of symbolic manipulation. Language is one of several different forms of symbolic activity. The child, in his usage of objects and in his play, gives other behavioral evidence of symbolic process. In the broadest sense, Piaget's symbol refers to anything which represents something a person knows. To be sure, in the young child, symbol usage may be egocentric and narrow, but nevertheless, the acquisition of language has enormous intellectual significance. This is the giant step from the sensori-motor level to the level of pre-operational thought.

9. Piaget deals with emotions as being the energetic or motivational aspect of intellectual activity. From the first, primary circular reactions on the human child strive to repeat

advantageous or interesting results which have value for him. Continued efforts require success. Gratification and pleasure become reinforcers.

10. Piaget's subjects have been normal children. His concept that the dynamics of intellectual functioning develop and operate according to the same principles at all levels of mental development has applicability for the exceptional child as well. It is these invariant principles, plus the hierarchic sequence of development in the "normal child" which we can, in educational programming, use as referents.

11. Finally, the method utilized by Piaget, that of careful, defined, organized, clinical observations, with emphasis on the significance of the dynamics of behaviors and inferred intellectual structures, has transference values in both assessment procedures and in the evaluation of programming.

In summary, Piaget's theory of intelligence is essentially sequential, hierarchical, integrative, dynamic, involving adaptive interaction between the individual and his world via the invariant functions of assimilation and accommodation. Experience then becomes the future base of symbolism or language which, in turn, via distancing and complexity, permits structuring of higher intellectual processes.

Our work at the DSNHC,SC, in providing in-depth multi-disciplinary assessments for some 150 children afflicted with the sequela of maternal rubella, has enabled us to provide a general description of our deaf-blind population, which is of significance in program planning.

Some main characteristics of the population.

1. Chronologically, most frequently between 5 and 7 years, although the range is greater.
2. Congenital heart defects.
3. Sensorineural learning losses -- functioning as severely or profoundly deaf.
4. Ophthalmological problems, as cataracts, nystagmus, classified as legally blind.
5. Severe developmental lags in all areas.
6. Self-stimulating, autistic-like behaviors.
7. Hypotonia.
8. Severe temper tantrums or self-destructive behaviors.
9. Little, if any, ADL (activities of daily living) skills.
10. Lack of appropriate affect or social relationships.
11. Lack or paucity of propositional behaviors (object concepts, utilizing toys appropriately, anticipatory behaviors, etc.)
12. No language-gestural or oral.
13. Mental ages ranging from 4 months to 22 months in cognitive areas.

14. Functioning at the Piaget sensori-motor stage of development.

The list above represents only some of the most common complications associated with the rubella syndrome. Others include microcephaly, growth retardation, seizures, poor vestibular function, microphtalmia, optic atrophy, cerebral palsy, and mental retardation. The addition of one or more defects undoubtedly results in geometrically compounded disabilities.

Piaget indicates that transitions from one level to the next are dependent on four factors.

1. Maturation, which is defined as the development or condition of the nervous system.
2. Experience.
3. Social transmission, linguistic or educational.
4. Equilibration, which is the completed organization of the stage.

The deaf-blind youngster's developmental difficulties, their inability to progress within the sensori-motor stage and beyond, can be understood within the Piagetian framework.

One of the most obvious problem areas is in the nature of the sensory deficits which prevent and obscure the transmission of data from the environment. This results in enormous experiential deprivation frequently extreme enough to be called denial. The aspect of adaptation referred to as accommodation becomes muted, dulled, and vague since the need to make adjustments is neither perceived nor experienced. Since the demand to accommodate is obscure, whatever impinges on the organism becomes assimilated. The central areas of processing cannot hope to deal with data that is not transmitted.

The factor of nervous system maturation in relation to growth cannot be properly assessed when typical environmental pressures are not experienced sufficiently to require a response which can modify a behavior. There may be central nervous system involvement in addition to the sensory difficulties.

The developmental lags in motor, cognitive, social, affective, and language areas can be in part understood, then, by the fixation on assimilative structures and the diminished demand of and for accommodative adjustments. This may explain apparent inability for the deaf-blind to learn incidentally as do normal children. It does not have reference to central processing functions. It merely deals with peripheral mechanisms and to the child being denied experiences. Implications for remediation include corrective surgical and medical procedures and devices, (example: cataract surgery, aphakic lenses, hearing aides, etc.) and the deliberate increase of strength and focus of any given environmental stimulus so that it is perceived, experienced, and accommodated.

Another significant area of difficulty for our children and one most important for educational planning is that these children present as fragmented. Body schemes which have evolved have not been integrated with other schemas. The number of schemas is limited. The coordination of

behaviors which seem to "unfold" automatically in normal children, do not with our youngsters. Tandem to this, the most incidental and basic associations have not been made. Movement is purposeless. Meanings have not been attached. Sometimes hearing is present, but the child has not learned to orient himself to sound or to seek out its source. For some, the primary reinforcement patterns typically established in the early sensori-motor stages are not as satisfying as the self-stimulating ritualistic behaviors frequently observed in the endless, all consuming obsession with photic play, rocking, ocular poking, whirling, etc.

Educational efforts must be directed toward the planned development of schemas in many areas, in the pressured integration of schemas, in the attachment of meanings, in the extinction of inappropriate reinforcement patterns, and the establishments of appropriate ones.

Our population then of multihandicapped, frequently are non-integrated, not receiving or perceiving data, not forming primary attachments or primary pleasure patterns, not accommodating appropriately to the demands of the environment, not forming a repertoire of elementary schemas, not integrating those they possess, and not developing concepts or cognition as evidenced by their limited propositional behaviors and in their inability to participate either receptively or expressively in any shared communication system.

It is doubtful that these severely handicapped youngsters will make significant progress beyond the sensori-motor stage which involves object concept development, organizations of experience, developing concepts of the physical environment, deliberate variations of behavior, and most important, the acquisition of language, unless intense, directed, and appropriate educational interventions are introduced and maintained. In our outpatient evaluations at C.A.'s up to about 7, an astonishingly high percentage of these youngsters have not entered the pre-operational stage of intellectual operations or progressed along the sensori-motor continuum.

Basically, the curriculum developed, applying the Piaget model for severely handicapped children, is below the traditional pre-school level. It can be better labeled an infant curriculum. Because of this, it is suggested that the milieu and focus of the classroom be as home-like as possible in an effort to recreate for these children experiences automatically enjoyed by normal youngsters but missed by the deaf-blind. It is most compatible with their present state of development and it is anticipated that it can thereby provide the setting for important learnings to be built upon and hopefully transferred.

The framework of the curriculum is developmental in the most basic sense. It is centered on the child's actual functional levels and geared to the next steps of the developmental hierarchy.

Experiences appropriate to the sensori-motor stages are not left to chance. Contact with selected environmental stimuli is forced. Needless, ritualistic, self-stimulating, assimilative

tendencies are interfered with. Focus is shifted to accommodation. Accordingly, there is a structured organization of schemes and structured integration of schemas. This encompasses experiences involving the stimulation and appropriate usage of r sidual senses and the demand for integrated responses by the child. The integration of body schemas related to environmental stimuli, the growth of "object" concepts, the development of imitative behaviors, and language attachments become the core of sensori-motor remediation. The completion of this state, i.e., its equilibration, is necessary for transition to the next level.

The major goal of the curriculum is to assist each child in reaching a greater degree of independence. The organization of the curriculum reflects a system of priorities and values which emphasizes the development of language and cognition. Language learning is the central theme. The integration of language learning with sensori-motor experiences is a major objective of the program. As with all forced accommodations, it requires focused, consistent, simplified, meaningful, and discrete language input associated for the child with given acts or objects. It has proved most successful in making these symbolic attachments to the child's experiential warehouse, to combine a sign and a word simultaneously, present it in association with a given concept and demand that the child loop it back. While at the early stages in programming, it is not known which language system will prove most beneficial, denial of either can only be considered as a possible denial of symbolic process. Further, it is urged that so-called "natural" gestures, essentially idiosyncratic, be abandoned in favor of international sign language, just as correct patterns of articulation be presented for receptive oral speech rather than idiosyncratic baby talk. Redundancy, single kernal units of "high probability meaningfulness" of signs and single words in specific associations are the keystone for the language input for our youngsters.

Broad areas of curriculum concerns for these severely involved children are:

1. Development of Skills and Activities of Daily Living

Each task or skill is analytically broken down into its smallest sequential parts. Objectives are to be expressed in behavioral terms. Specific appropriate language input is to be associated with a particular activity or stage in sequence. (emphasis on verbs)

a. Self care

1. Undressing

2. Dressing

3. Areas of hygiene

4. Toileting

b. Self feeding (normal diet)

1. Finger feeding
2. Drinking from a cup
3. Use of a spoon
4. Use of a fork
5. Use of a knife
6. Pouring
7. Setting table
8. Clearing table
9. Washing and drying dishes
10. Putting away utensils

c. Object usage

1. Appropriate use of toys and objects in environment
2. Choosing toys independently
3. Replacement of toys and objects in proper places

2. Objectives in Areas of Motor Development

Vehicles for language input (example: "up," "walk," "crawl," "come," "go," "stop," etc.)

a. Gross

Competence and skills in use of body, large muscle coordination, etc., to be expressively stated in terms of behaviors as:

1. Body control

a. Holding head upright, turning
b. Sitting
c. Swinging, etc.

2. Skills of movement

a. Rolling
b. Crawling
c. Walking
d. Running
e. Jumping
f. Hopping
g. Trike riding

b. Fine

Vehicle for language input ("eat," "take," "put," etc.) Using and integrating residual sight with arm and hand schemas in behaviors of:

1. Eating
2. Puzzles, formboards, pegboards, bead stringing, hammering, etc.
3. Painting
4. Stacking blocks
5. Color and form matching
6. Repeating patterns

3. Social Behaviors

a. Development of tolerance, awareness, and appropriate interactions with other children, adults, pets.

b. Discrimination in identification of people and social expectations and roles.

c. Imitative behaviors and sequences of behaviors related to roles.

4. Emotional Behaviors

a. Elimination or dimunition of auto-stimulating activities (rocking, twirling, photic and ocular play).

b. Greater awareness of feeling states, including greater range of affect, tolerance, and pleasure in association with affection and body contact.

c. Expressing emotions appropriately.

5. Language and Cognitive Objectives

(total communication, combining sign and word)

a. Use and coordination of residual senses as related to language acquisition.

1. Awareness of sound, seeking out sources.
2. Awareness of visual stimuli, seeking out sources.
3. Discrimination of both auditory and visual stimuli.
4. Attaching meaningfulness to auditory and visual stimuli.
5. Following directions, oral and/or sign language.
6. Expressive signing or oral speech.

b. Object concept development.

1. Primary circular reaction (1 - 4 months)

Involves integration of reflex action with higher activities characterized by repetitions of patterns.

a. Awareness and responses to objects, either as a response to present visual and auditory stimuli.

b. Coordination of vision and sound.

c. Coordination of vision with grasping.

2. Secondary circular reactions (4 - 8 months)

Involves reproduction of chance movements that produce an effect noted by the child and beginning decentration or distancing between self and object.

3. Coordination of secondary schemas to new situations (8 - 12 months)

Tertiary circular reaction (12 - 18 months) involves beginning experimentation and trial and error solutions.

4. Formation of new schemata in unfamiliar situations

5. Beginning of new solutions without overt trial and error behavior (18 months on). Involves the beginning use of symbolism and mental combinations of symbols.

6. Establishment of language system of symbolic referents, building of ideas and concepts immediately attached to the child's own experience. Increased development in object concepts can be inferred by child's play, role taking, etc. It involves increased distancing from the sensori-motor experience and a stage of knowing characterized by growth in child's ability to recognize the independent existence of physical objects apart from his own egocentric relationships.

c. Objectives in the area of imitative behaviors.

Piaget analyzes imitation as being almost pure accommodation.

1. Sequence of imitative skills.

a. Primary circular reactions (1 - 4 months)

(1) Activation of schema (faint beginnings of imitation)

(2) Integration of schema

b. Secondary circular reactions (4 - 8 months)

(1) Imitations repeated within repertoire

(2) Imitations stimulated by visual or auditory stimulus.

c. Imitations refined by conscious matching to model (8 -12 months)

d. Tertiary circular reactions (12 - 18 months)

(1) Imitations remembered without physical cue being present beyond an immediate stimuli. Imitations become more exact and advanced.

e. Imitation becomes automatic of all models and begins to be deferred. It reaches the levels of inner representation, i.e., symbols, and involves distancing beyond the immediate physical stimulus.

(1) Schemas associated with symbol.

(2) Schemas activated by its referent symbol.

(3) Schemas and symbols utilized in new situations.

2. Areas of imitative behaviors.

   a. Gross motor

   b. Fine motor (example: signing, writing)

   c. Auditory

   d. Affect

Implementation of Curriculum

Awareness of the complexity and severe involvements of the deaf-blind children makes mandatory a highly individualized approach in order to insure implementation of the sequence of developmental tasks categorized in the curriculum.

The basis of individualizing the program is the determination of the individual child's functional level. A team of specialists representing medical, audiological, and ophthalmological disciplines is valuable for obtaining history and essential for determination of intactness of the various systems or where breakdowns occur. An obvious corollary are related recommendations for corrections and alleviation of symptoms or conditions. Speech, hearing, and language assessment can provide information as to the states of the hearing mechanism and the use the child is making of it, the stages of language development, and specific suggestions as to amplification needs, language emphasis, and methods of developing this area. The role of the psychologist, after adaptation of standardized testing instruments for the deaf-blind, is invaluable in indicating cognitive status as distinct from motor abilities, and ascertaining levels and structures in Piagetian terms. At the DSNHC,SC, the educational assessments utilize the Maxfield-Buccolz Social Maturity for Use with Preschool Blind Children, the Else Haeussermann Education Evaluation for Preschool Children, and various informal techniques to determine functional levels. These involve observation of matching abilities, object concepts, imitative abilities, integration of schemas, problem solving, concept development, as evidenced by appropriate behaviors and play, projective use of sight and hearing, and manner and attempts to communicate. Recommendations emanating from the educational assessment should have specific classroom applications and represent a synthesis of the multi-disciplinary team approach. The prescription then can be integrated and integrative.

Development of the Prescription: Stated in terms of behavioral objectives.

A behavioral objective is a description of a pattern of behavior or activity we want the child to demonstrate. It should be observable, measurable, and for the deaf-blind, should be highly specific. The choices should be based on the assessment of the child's functioning in various curriculum areas and geared to the next level in the developmental hierarchy.

While the process of delineating behavioral objectives enables one to focus on specifics, it may have the disadvantage, if conceived of too literally, of segmenting our interventions. It is

because of this tendency and the inherent difficulty of dealing with long lists of behavioral objectives that prescriptions for the child be stated in unifying terms. Basically, this involves the logical grouping of objectives and their forced integration for the child. By defining objectives, you insure accurate pinpointing of developmental needs and tasks. By grouping and organizing these, you insure integration of schemata more purposefully and at levels of increased complexity. An example might be self-feeding at the level of spoon usage, assuming the presence of the grasp reflex and knowledge of location of the mouth.

Grouping the Objectives

1. Use of residual sight to locate the food and the spoon.
2. Coordination of hand and eye.
3. Balancing food on spoon.
4. Transferring food to mouth.
5. Association of sign "eat" and the word "eat" with the act of eating, thereby fulfilling language learning objective.
6. Propositional use of the spoon.
7. Diminuition of spoon waving for photic stimulation by not allowing inappropriate usage.

Techniques and Strategies to Accomplish Behavioral Goals

The methodology employed to fulfill the objectives for the children involves four basic themes.

The first is the principle of task analysis or the break-down of any given task into miniscule sequential components. This prevents any step being overlooked and insures built-in opportunities for reinforcements in the successive approximations involved in the sequence. It is the most sensitive indication of where the child is, i.e., concept of the match.

The second theme is in regard to the techniques of organizing desired behaviors with reference to levels of interaction of the attending adult with the child. These must be coordinated at all levels with specified language input. They are:

1. The reflexive level, i.e., proprioceptively moving the child through the total behavior sequence.
2. The reinforcement levels, i.e.,
   a. behavior modification
   b. operant conditioning
   c. contingency management
3. The symbolic level, i.e., the use of language as a mediator.

The theoretical justification for the employment of these techniques involves in itself the principle of sequential development from the most primitive to levels of increased sophistication.

Physical sensori-motor-type learnings proceed to symbolic levels. Levels of reinforcements also proceed from primary and more primitive levels to more social, symbolic levels.

The third theme is the structured, controlled and consistent application of strategies. It is difficult to convey the degree to which these children require "over-learning." The establishment in Hebbian terms of a "cell assembly" for the Deaf-Blind requires clear cut, repetitive associations where confusion, inconsistency, and weak stimuli cannot be risked. This is the essence of assimilative adaptation.

The fourth themeis the need for ongoing evaluation. This involves the determination of acquisition of the desired behavioral objectives, the development of statements of new objectives and frequently, the review and revision of unsuccessfully met goals.

The last part of this paper will be a brief presentation of three case studies of children in the residential program at the DSNHC,SC.

Discussion will be organized around the findings and recommendations of our Diagnostic Team, the individualization of the program, and some of the educational strategies developed to implement the objectives. The children have been chosen because, at the time of their initial assessment, they represented three levels of the Piagetian sensori-motor stages, i.e., low, mid, and high.

D.W. b.d. 3-12-65

D.W. was evaluated by our team at the DSNHC,SC, in June of 1971. In addition to the rubella syndrome of sight, hearing, and cardiac impairments, he had suffered from neonatal hypoxia, hepatitis, and cardiac failure at age 3. He had been living in a residential facility along with 40 other crib cases for several years.

In mid-September, 1971, at CA 6-7, when he was enrolled in our program, he was totally dependent in all activities of daily living. Brought in tied to a wheel-chair, with head slumped to the side, he was indifferent to everything except light. He was functioning in the low-sensori-motor stage of development, and achieved an M.A. of 4 months with a basal age of 2 months.

Behavioral objectives plotted for D.W. were global. In the areas of activities of daily living, they included toilet training, self-feeding with fingers and spoon, development of ability to consume table foods, development of abilities to undress, dress, to participate in and develop skill in areas of hygiene. Priority was also given in the area of gross motor skills involving head control, rolling, crawling, standing, and possibly, walking. In the fine motor area, development of a grasp sufficient to permit some self-feeding was stressed. In the area of language and cognition, objectives were the development of the projective use of hearing, toleration of head phones, and the development of the use of his residual vision. Some primitive object concepts and

limited propositional behaviors were hoped for.

Prime emphasis was on the development of new schemas and integration between them. After grouping our objectives, a consistent routine and sequence within that routine was worked out. In all behaviors, including gross and fine motor acts, and in the development of his projective use of hearing, D.W. was proprioceptively put through the acts. Each schema was analyzed. Accommodations to environmental stimuli were demanded, forcing the child to participate in the integrated sequence. Specific single units of language input accompanied all activities and were constantly repeated during the sequence.

D.W. has made great strides in his physical development during the past eight months of residence in the Diagnostic School. He has learned to sit for prolonged periods on both chairs and the floor, maintaining good head control. He has mastered the skills of rolling, crawling, pulling himself up on objects in his environment, as well as getting up by himself. He has learned to walk independently, frontwards, backwards, and sidewards, and negotiate stairs with alternate feet. He jumps, holding on, and can steer and propel wheeled toys such as kiddy cars and tricycles.

He is beginning to use and integrate these new skills in self-initiating exploratory expeditions. If not involved with an adult, although he still lies down on the floor to engage in his auto ocular and photic rituals, he is beginning to make consistent efforts to look about, and seek out, and gaze upon, and handle meaningful objects or associations in the room such as toys, the feeding table, etc.

D.W. has developed a functional palmar grasp this year and now reaches out to secure objects which are bright, shiny, and make sounds, as well as objects well known to him. He can pick up and release blocks, small and large. He can place rings on a stick and remove them. He has the ability to use a spoon independently and to scoop up the food with great discriminating precision. However, his main interest in the use of his hands still remains in ocular stimulation and shadow play. He must be highly structured in any other activity. Since he has learned to associate certain words with certain activities, the use of these (limited as they are) can successfully determine his actions.

D.W. has completed toilet training to the extent of retaining control for as long as five hours, cooperatively using toilet facilities, pulling up his pants on command. He has learned to finger feed. He has learned to search out a spoon, pick it up, scoop up food, and eat without assistance. He drinks from a cup but has difficulty replacing it upright.

D.W. has changed from an indifferent, totally encapsulated, self-stimulating child to a seeking-out, affectionate, responsive, and reactive little personality. He laughs with delight. He anticipates routines. He enjoys being loved and demands it. He tolerates contacts. He expresses fear,

pain, and annoyance.

In terms of receptive language acquisition, D.W. can now respond to about 15 single oral words differentially. In his increased interest in his environment, in his ability to relate to objects, in his increased skill in taking care of his needs, in his beginning imitative behaviors, his greater skills in relating to people and objects, and in his clear-cut response to verbal commands, he has demonstrated that he can learn. At CA 7-3, he functions in the mid sensori-motor stage of development, at about a-year-old level in language and cognition. He now measures 2-6 years in motor abilities, and increased in social age over 2 years, as measured by the Maxfield-Buccholz Scale for Pre-School Blind.

C.M. b.d. 2-20-65

C.M., when evaluated by the Evaluation Team at the DSNHC, SC, during the week of July 14, 1970, was found to be functioning cognitively between 8 and 12 months and was at the mid sensori-motor stage, according to the Piaget framework of development. Physically, she suffered from bilateral optic atrophy, marked nystagmus, a severe to profound sensori-neural hearing loss, which was variable. Her vocalizations were unintelligible. She was ambulating, and in motor tasks, achieved a 3-year-old rating. She had no symbols, and projective use of hearing was so intermittent as to be considered not present. Little propositional behavior was evident. She was functioning between 12 and 18 months educationally. She was said to be independent in feeding herself and was reported to have partially accomplished toilet training.

C.M. entered the class at the Diagnostic School September 14, 1970, at CA of 5 years, 7 months. She presented in the class as a child having gross mobility and gross vision, but no functional hearing. She was able to ambulate freely around the classroom when well lighted, but when illumination was diminished, she would stumble into known permanently situated objects. In the fine motor area, she functioned as a totally blind child, crudely groping and frequently turning her head away from the task at hand. She was an intensely social child whose main interest was in affection, love, and hugging. Toilet training was not established. Her attention span was fleeting, and she babbled incoherently when older children were around. She drooled and chewed things constantly. She had the ability to propel a tricycle, but in all other gross motor activities, had much difficulty. She was subject to frequent, violent temper tantrums, which were characterized by her slumping to the floor, screaming, kicking, and usually culminated in her pulling out her hair and biting her hand hard enough to bleed.

The diagnostic team's prescription was to correlate gross motor with auditory training, more ADL, more interaction with objects, and assistance in adjusting to a hearing aid.

Behavioral objectives planned for C.M. in the area of activities of daily living were completion

of toilet training, establishment of normal eating patterns (regular meals, no snacking, acceptance of a variety of foods and textures, eating single handed with a spoon), undressing and dressing, washing and drying face, hands, and brushing teeth. In the area of gross motor, we hoped to develop skills in ball throwing and catching, climbing, balance board, jumping, climbing stairs, and running. Fine motor goals were coordination of residual sight with hands and greater skill in the use of the pincer grasp.

In the area of affect, the sole emphasis was on control of the temper tantrums and self-destructive acts. In the area of language and cognition, more objectives were planned. They included increased response to sounds gross and human, adjustment to head phones, increased use of residual vision as related to gross mobility and fine eye-hand coordination, greater task orientation, work set, developing shape and size discrimination, color matching, and increased abilities in imitative skills.

Whenever possible, these objectives were grouped. Gross motor skills were combined with her use of sight to guide herself. To help her gain information about where to place her arms, hands, and legs, the use of a flashlight was employed, focused on the area requiring her gaze. All language input consisted of single verbs coordinated with the action, such as "crawl," "walk," "climb," and "jump." Frequent changes of movable objects and furniture were instituted, forcing her to scan her environment. This, too, was integrated with verbal communications -- at first, "eyes," then, "use your eyes," "see the chair." If she proceeded heedlessly, we stopped her, directed her gaze, and repeated the stimulus word. Similar strategies were employed with changing angles of the walking boards and climbing apparatus and placement in terms of light sources.

Combining objectives for fine motor skills and development of residual vision involved the prevention of the use of the left hand, and use of a pen light for spotlighting the proper dimension of the task. Systematic searches for sound sources, increasing the auditory stimulus, screening out ambient noise, not permitting a significant word to be ignored, and insuring reinforcement for the search, were strategies used to develop the use of her residual hearing and develop some of the necessary prerequisites for language acquisition.

In Piagetian terms, C.M.'s remediation was planned around the evolution of new schemas and their integration, forced accommodation to environmental stimuli, and the attachment of symbols to meaningful experiences to promote mediation of her behavior.

C.M., after 9 months in residence in the DSNHC,SC, made considerable progress in ADL skills. She has almost completed mastery of the skills of dressing and undressing, toileting, hygiene, etc., the use of spoon and fork, and has extended her range of edibles. In the area of gross motor abilities, C.M. now can safely navigate through space, no longer groping as a blind child, but is able to

use her sight to guide her. Skills in climbing, jumping, and trike riding have improved. In the area of eye, hand, fine coordination, C.M. still has many problems. However, when she uses her residual vision as a coordinator, she shows marked improvement in her performance.

In readiness-type skills, C.M. has learned to do simple puzzles, to serially grade by size, to discriminate shapes and colors, and to engage in simple matching activities. C.M.'s greatest gains have been in language development. She has learned to wear a hearing aid, responds to auditory stimuli, scans her environment for sound cues, responds receptively to a great number of single words in her regular milieu, is beginning to pick cue words out of a short phrase, follows simple directions, and spontaneously uses about 25 single words meaningfully. She is now in the high sensori-motor level of intellectual operations, and by virtue of her language development (the attachment of symbols to concrete experience), she is in transition to the pre-operational stage. She has gained 10 months to 1 year in M.A. on the Cattell and Preschool Attainment Record, and 18 months in S.A. on the Maxfield-Buccholz Scale for Preschool Blind Children. On the Else Hacussermann Educational Evaluation of Preschool Children, she demonstrated an 18-month increase.

C.D. b.d. 12-9-64

C.D., when assessed by our team, was found to have a profound bilateral sensori-neural hearing loss, clinically considered legally blind, ambulating independently, could feed, toilet, and semi-dress herself, functioning educationally at a 2½ to 3 year level and at a high sensori-motor level, according to Piaget criteria. No language development had taken place. There were indications of hyperactivity and self-stimulating behaviors such as light gazing and rocking. In the classroom, C.D. presented as a child with excellent mobility, good fine and gross coordination, good imitative skills, good task orientation, with ability to match color, shape, and do complex puzzles, with a cold, dull, bland affect which was occasionally broken by a temper tantrum. She had no gestures, nor even a nod for "yes" or a headshake for "no." Gestures had been taboo in the family for 3 years when they embarked on a program of auditory training.

Behavioral objectives were complete independence in dressing and undressing, gross motor skills of hopping, skipping, and riding a two-wheeled bike. In the area of affect, a greater range of emotional expression was hoped for, with emphasis on the display of affection and the diminuition of the ritualistic rocking. In the cognitive-language area, increasedcomplexity in matching, completing patterns, matching pictures to printed words, beginning number concepts, and most important, the establishment of sign language and finger spelling.

No special strategies were needed for gross and fine skills. C.D. clearly had no problems here, so enforced opportunity alone was sufficient. Remediation of affect was approached by handling her as much as possible, smiling, hugging, and kissing her frequently. Efforts were made to get her to

apply her imitative skills to people and objects around her. The strategy to stop the rocking was not to allow it. She was given a "no" sign and then directed to another activity. The language program was centered around signing. All signs were introduced in situations of and for "high probability meaningfulness" and then associated again and again with the hope of tying it up meaningfully to an experience. No activity was allowed to continue until she imitated back the stimulus sign.

C.D. made dramatic gains during her 9 months of residence in the DSNHC,SC. She became completely independent in all areas of ADL from tieing her shoes, to using a fork and knife, to being integrated with the other children in the school during meal times and in other activities. She monitored herself in these routines by signing to herself. In the area of motor skills, her big accomplishments were learning to ride a two-wheel bike without training wheels, and to jump rope. Socially and emotionally, significant changes were noted. She had learned to tolerate sustained physical contacts with her peers. She could work in a group and rarely had a tantrum when frustrated. All rocking and light gazing had ceased, both at home and at school. She had learned to express affection and love and expressed her feelings in signs.

In the area of language and cognition, she had established signing and finger spelling as her primary language system. She has learned over 175 signs this year and uses them appropriately, receptively and expressively. She knows most of the manual alphabet, number concepts up to 10, can serially grade by size, can reproduce complex block and bead patterns from a model or a picture, has concepts of large and small, can draw pictures from signs, is learning to match printed words to pictures. On the Preschool Attainment Record, she showed a 43-month gain. She achieved an MA of 5-7 months on the Arthur Adaptation of the Leiter and showed a growth of 30 months in Social Age, as measured by the Maxfield-Buccholz Scale of Social Maturity for Use with Preschool Blind Children. On the Else Haeussermann Educational Evaluation of Preschool Children, C.D. demonstrated a 33-month gain.

SENSORY INTEGRATIVE PROCESSES: IMPLICATIONS FOR THE DEAF-BLIND FROM RESEARCH WITH LEARNING DISABLED CHILDREN

A. Jean Ayres, Ph.D.

I do not bring you answers specific to the problems of the visually and auditorily impaired child; rather, I bring you hypotheses and ideas that could lead to an extension of existing educational practice which would enhance the multiply handicapped child's potential for learning.

Related Research

These ideas have evolved primarily out of research with children who have learning disorders associated with minimal brain dysfunction. In our research on remediation of the sensory integrative (including perceptual-motor) deficits associated with the academic learning problem, results have been positive and hold important implication for remediation with all children who have disorders of sensory integration and perception. Sensory integrative dysfunction is distinguished from primary sensory loss due to damage of the receptor organ.

Briefly stated, the research demonstrated that sensory integrative activities and procedures helped learning disabled children improve in academic test scores (Ayres, 1972).

Matched control and experimental groups were employed, the control group receiving in place of sensory integrative activity, the equivalent amount of time in classroom experience. Differences between pre- and post-test scores of the experimental and control groups were compared. Sensory integrative procedures utilized sensory input and adaptive motor responses that replicated early childhood development and emphasized normalization of reflexes and neural mechanisms, especially those mediated largely through the brain stem. The procedures are remarkably similar to the motor or free-play experiences currently provided in special educational programs. The main difference lies in manner of use of the equipment and the kind of help given the child in its use.

Since types of perceptual difficulties of learning disabled children differ, the sample population was divided into two groups according to pattern of perceptual-motor test scores:

(1) A fairly good sized group (N= 31 experimental and 37 control subjects) showed classical signs of visual perception disorders and usually, but not necessarily, auditory-language problems. This experimental group showed statistically greater gains over their matched control group in academic work in general, but especially in reading.

(2) A much smaller group (N= 12 in experimental and 12 in control group) was composed of children whose only identified cause for academic trouble lay in the auditory-language domain. Of this group, the children receiving the remedial activity improved more than their matched control group in reading ($p < .01$). The gain in spelling approached,

but did not reach statistical significance. The change in reading capacity of the children with reasonably discrete auditory-language problems is particularly significant in view of the fact that the remedial program under test did not include any language training and virtually no training in auditory perception in the conventional sense. The remedial program focused on the type of sensory integration that develops in the child before cortically mediated auditory and visual perception mature. The program stressed sensory learning through sensory experiences which normalize total function. Unlike the customary focus of conventional educational programs, little emphasis was placed on cognitive or conscious learning.

The research results, along with interpretations of basic neurobiological research, have led to formulating two hypotheses which hold great significance for any remedial approach to conditions of disordered sensory integration. The first hypothesis holds that perception in the different sensory modalities develops in an interdependent manner, maturation in each modality being somewhat dependent upon maturation in other sensory modalities. The second hypothesis (offered with less assurance because of the lesser quantity of supporting research) suggests a hierarchical sequence of development of the sensory systems. As in motor development, each step in the sequence is somewhat dependent upon maturation of previous steps.

It is proposed that the tactile and vestibular systems are among the first sensory systems to develop integrative capacity, and that maturation of neural mechanisms in these systems help maturation in the later developing auditory and visual systems. The vestibular system responds to the earth's gravitational force and to movement of the head in space. (It is recognized that the olfactory and gustatory systems also develop early. Their role in the development of the other sensory systems has not been postulated as well as it might be.) This proposed sequence of sensory development is consistent with that observed in animals (Volokhov, 1970, and M. Fox, 1970).

The proposition that maturation of integrative mechanisms of the tactile and vestibular systems contribute to the development of the visual and auditory systems is consonant with the remedial procedures employed in the research with learning disabled children, and with the results of that research. It is believed that careful and appropriate stimulation of the vestibular system promoted auditory processing which, in turn, helped the child to learn to read. Adequate neuroanatomical basis for this proposition is found in the research showing that input over the tactile and vestibular systems frequently converges with the auditory and visual input at multiple areas of the brain including individual neurons (Jung, Kornhuber and DaFonseca, 1963; Fessard, 1961; Eccles, 1966; Albe-Fessard, 1967). Furthermore, it is generally agreed that the auditory system evolved out of the vestibular system (cf. Bergeijk, 1967) and that the more recently evolved functions

never entirely lose their dependence upon the earlier functions out of which they developed.

That the sensory systems develop in an interdependent manner and that remedial procedures can employ one sensory modality to influence development in another, represents considerable advance in our thinking. This insight may have profound significance for the education of children with various degrees of sensory integrative impairment.

The implication of this point of view on the young visually and aurally impaired child deserves consideration. There are no "hard data" to date to support the postulate that remedial efforts based on these findings will be more helpful to the deaf child than present procedures, but the few centers in a position to make a clinical judgment have reported positive results, especially in increasing auditory acuity and language development. One center attributes the gain largely to vestibular stimulation.

These impressions are too significant to go unheeded.

In addition to the influence of one sensory system on another through developmental processes and through convergence of sensory input, intersensory influence occurs through the stimulation of the reticular activating system. This neural mechanism has been recognized for a number of years. Thus J. Fox, (AJOT 1965) demonstrated increased scores in tactile discrimination by blind children following introduction of the aroma of oil of peppermint into the classroom. The enhanced perception was believed to be a function of the reticular arousal system.

Implications for the Deaf-Blind School Child

Determining whether remedial procedures based on these concepts might help to meet the educational objectives of deaf-blind children involves analysis of the problems presented by these children. Although various causes for visual and aural impairment among children in the public schools exist, congenital rubella is by far the most common cause (ESEA Project, 1971; Stein and Green, 1972). The pertinent question is then:

To what extent do children with congenital rubella have sensory integrative deficits? (Sensory integrative deficit is defined as the inability to utilize sensory information. Initially, all learning is a sensory integrative process.)

Even when one is looking for them, disorders of sensory integration are difficult to detect in the child with no disorder in the visual or auditory receptors. When the child is blind and/or hard of hearing, recognition is especially elusive. Children with congenital rubella tend to have major medical problems that command the physician's attention (cf. Esterly and Oppenheimer, 1969; Schiff, Sutherland, Light, and Bloom, 1965; Horstmann and Associates, 1965). Central nervous system involvement is only one of many initial medical problems, and the more subtle irregularities of function of this system are more likely to be detected by the educator for whom they present major obstacles.

Problems presented to the special educator which are highly suggestive of disordered sensory integration include motor delays, diminished muscle tone, mental retardation, speech and language disorders, perceptual problems, emotional disturbance, delay in daily living and adaptive skills, attending behavior, and disorder of the tactile system (ESEA Project, 1972; Desmond, Montgomery, Melnick, Cochran and Verniaud, 1969; Franco, Riley, and Chitwood, 1970; Roche, Sheehan, Lydia, Walsh and MacAirt, 1971; Stein and Green, 1972; Leach, 1971). Stein and Green (1972) have observed limited use of tactile, kinesthetic, gustatory, and olfactory systems in deaf-blind children with congenital rubella. The authors suggest that in these children "integrative learning is not spontaneously developed at even the lowest level." Similarly, Calvert, Reddell, Jacobs and Baltzer (1972) found in their pre-school program for the deaf-blind that they had a tendency to approach the child at too high a developmental level. They suggest the first concern to be the organization of the environment, then control over the environment. The authors found these steps necessary before conditioning would work. Disorders of hearing and language are among the most common manifestations of congenital rubella (Streissguth, Vanderveer, and Shephard, 1970; Siegel, Fuerst, and Guinee, 1971; Weinberger, Masland, Asbed, and Sever, 1970; Halpern, 1970). There is growing evidence that in many of the children, part of the auditory problem is a perceptual or sensory integrative one (Ames, Plotkin, Winchester, and Atkins, 1970; Gumpel, Hayes, and Dudgeon, 1971). In fact, in a study of 118 children with congenital rubella (Ames, Plotkin, Winchester, and Atkins, 1970), central auditory imperception was the only cause of 30 of the children to respond to sound. An additional number were found to have central auditory imperception in association with peripheral hearing loss.

Very little attention has been directed to the sensory integrative functions of the vestibular system in any group of children with brain disorders. Considering how little is known of this aspect of that sensory system and the commanding nature of the other problems presented by the child with congenital rubella, it is understandable that few observations have been in this area. Frost and Miller, (1971) specifically studied vestibular function by observing the effects of ice water in the external ear canal on nystagmus, a reflex movement of the eyes following vestibular stimulation. Out of 99 children, 41 showed an impaired response. Hearing loss and impaired vestibular function tended to, but did not invariably go together.

Additional suggestion of disorder in some aspect of the vestibular system in the young congenital rubella child was found by Zausmer (1971), who studied motor deficits in 43 children. Relatively few children were completely normal motorically, and many had balance problems.

Studies of individuals with hearing impairment of unknown or unspecified etiology associate that impairment with visual-motor retardation (Keogh, McCay, and Smith, 1970) and behavior problems (Stewart, 1971; Meadow and Schlesinger, 1971). Visual perception problems in the congenital rubella

child have not received emphasis in the literature.

The Potential Role of the Educator

Education of the multiply handicapped deaf-blind is now focusing on the pre-school child, as young as 3 years of age chronologically (for example, ESEA Project 1971; Connor, 1971; Parten, 1971); therefore, a better opportunity arises for enhancing sensory integrative development. One of the major tasks of any child's first three years is the development of his sensory systems so that he can establish his own physical and emotional identity and learn to interact with his physical and social environment. Helping the child to become more sensorily aware is an appropriate educational objective; helping the child to become more capable of awareness and discrimination through improved neural function would appear to be an effective addition to the already existing educational objectives.

The major goal in promoting sensory integration in the multiply handicapped deaf-blind child is enhancing his general learning capacity; some more specific objectives are worthy of consideration. The child with reduced dependence upon his visual or auditory systems for relating to the social and physical environment must compensate by placing more dependence upon the tactile, kinesthetic, vestibular, and other proprioceptive systems.

Discriminative tactile perception is closely associated with the ability to motor plan. Manual language and finger spelling represent some of the most difficult demands of motor planning that can be expected of a child; yet manual communication taught at the pre-school level has been demonstrated to give the child an education advantage (McCay and Koh, 1971). It would seem appropriate, then, to attempt to normalize a child's tactile system in order to enhance his ability to plan skilled movements. Furthermore, as Whitcraft (1972) points out, interpretation by the blind child is initially dependent upon sensing the separation of body boundaries from the environment. The body's boundaries are perceived through the tactile sense.

The child's ability to relate himself to the spatial aspects of environment are initially dependent upon the vestibular system which tells him where he is in relation to the earth's gravitational force, the direction he is moving, and how rapidly he is moving. Later in the maturation of the child with normal sight, vision assumes an important role in relating to space. The development of visual space perception is strongly dependent upon adequate functioning of the vestibular system. The child with impaired vision remains more dependent upon the vestibular system for orientation and mobility. This system, which is frequently involved in any central nervous system disorder interfering with learning, is especially deserving of careful attention by the educator of the blind child.

Experience with the learning-disabled children leads to the firm hypothesis that vestibular stimulation and organizing and emitting an adaptive response to that type of stimuli, are basic to subsequent developmental steps, not only in the motor domain, but also in some areas of academic achievement. Most of the basic postural reflexes are dependent upon adequate interpretation of vestibular and other proprioceptive input. Any remedial work with young children with sensory integrative disorders should include attention to the maturation of postural reflexes. The opinion of Paul Schilder, (1964) seems correct: The vestibular system appears to be involved in intersensory relations and tends to unify the various senses. Schilder also proposed that motor reactions were closely connected with general psychic attitudes, and that unsolved motor problems, especially concerning the security of equilibrium, could be one of the factors in later development of anxiety neuroses.

That the educational problems resulting from congenital rubella in children are not likely to diminish in Southern California in the immediate future, is suggested by a 1969 serologic study (Sever, Hardy, Nelson, and Gilkeson, 1969) among three groups of pregnant women.

The data from Los Angeles showed a frequency of susceptibles considerably higher than that found in other parts of the country, even before the 1964 epidemic. Seven per cent of pregnant women tested from Baltimore and Memphis were at risk for rubella (no HI antibody), while 31 per cent of the women from Los Angeles were susceptible. In Hawaii and Puerto Rico, almost 50 per cent of the women of child-bearing age were susceptible to rubella.

The near future, then, may see an increasing number of school children with multiple handicaps resulting from congenital rubella. Auditory and language problems probably will be frequent among this group. In addition to teaching the child, in spite of his hearing problem, it is suggested that there is a high probability that the perceptive auditory problems could be reduced in some of these children. The potential effect on visual perception is not yet hypothesized. If this should be the case, not only would educational objectives be met more easily and with less expense, but more importantly, the lives of some children would be more fulfilled.

For those children whose auditory and visual processes cannot be altered through procedures known at this time, enhancement of the function of the remaining sensory systems may add to the general adjustment of the deaf-blind child.

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A PROGRESS REPORT ON COMPLETION OF THE "NEAR PERFECT CITY"

Synthesis of Symposium Proceedings

Donavon McClard

There are 5,000 reasons for your participation at this national symposium for deaf-blind children, for that is the approximate number of school-age children whose needs you and your colleagues seek to meet.

During the three days of this symposium, your deliberations have been pragmatic, but shaded with concern and interest over the need for a theoretical framework to guide program planning and development. The spirit of the presentations and discussion has been that of establishing coordinated and comprehensive services that assure early, adequate assessment and treatment, followed by lifetime planning for those who will require such assistance.

Some of you may feel frustrated because closure has not been made on describing solutions to the problems of assessment and treatment. If you are troubled by the complexity of the problem of providing diagnostic and treatment services for the child with auditory and visual impairment, it may be instructive to consider some "basics" for planning. I would like to call your attention to eleven "someday" goals that the mother of a deaf-blind child views as significant for her child. I am indebted to the staff of the Azusa (California) Multi-Handicapped School for calling my attention to these parsimonious goals. This mother wishes the following for her child:

1. I wish foremost for my child to be happy.
2. I wish my child to be educated to the extent of his abilities and capabilities of using his education.
3. I would like him to have enough daily living skills so that he will not feel he is a great burden.
4. I would like to see my son continue to be happy with himself so that others will continue to be happy being around him.
5. I would like to see my son be content in using his leisure time wisely.
6. I would like companionship for my son, both with normal men and women and with other handicapped people.
7. I would like my son to have an appreciation of beauty; to be able to choose that which is good over that which is valueless.
8. I would like my son to pick up after himself; to put his clothes away where they belong, his belongings away, etc.
9. I would like him to be able to maneuver himself at least enough so that I will not be afraid to leave him alone for short times.
10. I would like him to be able, when he goes to a doctor, to tell the doctor what is wrong -- where it hurts, and what the symptoms are to make him want to see the doctor.
11. I wish to God I knew how to help him accomplish these things.

These wishes for a deaf-blind child seem reasonable and specific. It is to this type of personal competency that we have directed our attention in the past few days.

Dr. Schlesinger, in her presentation, related a parable that significantly parallels the growth of programs and services for the deaf-blind. That parable I would like to use in considering the proceedings of this symposium.

Since beginning the planning and building of the "near perfect city" (programs for the deaf-blind)

some years ago, we have made great strides in attaining completion of that city on the "unknown terrain." We are much closer today than when educators, at a special institute five years ago in Hollywood, California, considered the problems of the multihandicapped. Some of the problems posed by the group then have been resolved and others remain. A basic question they asked then was: "Who should assume responsibility for the multihandicapped?" We have the answer to this question today. The national network of centers for the deaf-blind, the acceptance by many state agencies of responsibility for the multihandicapped, and your vigorous efforts on behalf of those children assert the positive action that has been taken on this problem.

The nature of the questions asked in 1972 are different from those asked in 1967. They asked, for example: "How do we organize to diagnose and evaluate the child?" Today, we ask the question: "How shall we make diagnosis and evaluation meaningful for the child and family?"

In following the parable of Dr. Schlesinger still further, it should be noted that we have determined answers to some of the questions about things that might keep us from our mission. If I sensed the feelings and outlook of our speakers correctly, I can say that the terrain on which you seek to build the city is fertile, looks penetrable, and it appears as though there are paths to carry the supplies. We acknowledge that some of the paths are small and fragile, but alternative routes are being explored. New tools are at hand and efforts are being made to lift the "shroud of secrecy among the wise men."

In your discussions these past three days, you have carefully analyzed observable differences among children -- ways in which the multihandicapped deaf-blind child deviates from base rate expectancies for non-disabled children, and ways in which they differ from children with single handicapping conditions. The mode, breadth, and intensity of the disabilities have been the parameters considered.

In viewing the problem of differences among exceptional children, the late Wendell Johnson, considering the problem from a semantic differential point of view, used to say, I am told, that: "A difference to be a difference must make a difference." You have specified those differences that make a difference in provisions for the multihandicapped. I cannot name them all, but I shall mention a few that seem salient:

1. A need for acceptance of different avenues through which the deaf-blind child can establish adaptive behavior;
2. An acceptance of the view that educators must keep their options open in considering different treatments at any point in the instruction of the child;
3. An acceptance of differences in point of view, held by professionals, towards the diagnosis and treatment of children;
4. A trend towards detailed specification of teaching strategies to be used with the children; and
5. What I take to be a concensus that we have an attitude toward teaching the deaf-blind child that "I think he can. . .I think he can. . .I think he can."

Carefully blueprinted delivery of services has been advocated, and from a systems analysis point of view, I perceive that we are at the halfway point in defining the nature of the programs and services that must be provided. In terms of goals, we know where we are going and have an idea of how we will know when we have arrived. We know the major things that will keep us from where we are going, although we remain somewhat uncertain as to how we will eliminate those things. There also are good approximations to identification of the milestones to the goal. It is at this point that we need work in two principal areas: describing the specific things/tasks that mark milestones towards total programs and services; and in describing the options available for getting those tasks done.

In accomplishing the analysis of options for completing tasks, whether it is administrative matters or instructional programming for the child, it may be useful to think in terms of variables, and particularly those variables that meet the test of educational relevance.

Repeatedly, over the past three days, variables have been considered either as main effects attributable to a single source, or more importantly, as producing main effects due to the interaction between variables. As a matter of fact, the interaction among educationally relevant variables has been a major focus of the deliberations.

I believe we have been distinguishing between two general classes of variables which Maynard Reynolds has called source variables and decision variables.

Source variables are the indicators of educational problems. Their disadvantage is that they do not indicate appropriate educational procedures. Low visual acuity, for example, is a condition that is a reliable indicator of special educational interest. Poor sight, however, is not a very good indicator of what educational procedures should be used with the child. This observation has been repeatedly verbalized here and elsewhere.

The relevant variables in deciding on educational procedures are decision variables. Decision variables include such factors as age, motivation, vestibular integrity, tactile discrimination ability, parent attitude toward low vision aides, and teaching methods. They represent only a small sampling of the important decision variables that count in program planning for the deaf-blind child.

The difference between source and decision variables is that the first are the basis of identifying the problem, and the latter are the basis for exploring the options available. I believe that you have discriminated between the two classes and have clearly shown interest in dealing with decision variables as the dynamic factors which must be dealt with in managing educational problems of the deaf-blind child.

In making placement and instructional decisions, our speakers and those of you who have verbally contributed, have pointed up the fact that simple zero-order predictors (intelligence, visual acuity, hearing loss) are far less important in planning than the interaction between the decision variables and alternative educational procedures available for the child. You have indicated that you want to know how aptitudes, skills, and attitudes singly and in combination, when matched to instructional procedures, affect the child's development.

Educational and instructional planning connotes a system, and the systems that have been described during this symposium have emphasized a trend toward evaluation and instruction that deals with molecular rather than molar aspects of behavior. We have repeatedly heard requests and suggestions for: performance task analysis; assessment that goes beyond the pass/fail condition; description of response/stimulus duration, amplitude and topography; determination of reinforcer hierarchies, and a myriad of other exemplars representative of the concern with molecular aspects of behavior. The focus, if you read clearly, is upon evaluating the effects of discrete decision variables in interaction with procedures and materials associated with attainment of operationally described goals/objectives.

The fact that categorization of children in programs creates problems has been caromed off the walls of this room in ringing fashion. You reject the "pigeon-holing" of children because it is prejudicial to the interests of individuals, and frequently in error. On the other hand, you recognize the value of "shorthand" notations regarding exceptional children as long as it is acknowledged that variability is implicit within the reference group.

Implicitly, if not explicitly, we have been encouraged to "keep our options open." I see that in the opening remarks of Dr. Calvert in directing attention to the professional pitfalls that we must regard, in Dr. Schlesinger's urging acceptance of differences among children, in Mrs. Robert's

recommendation for controlled risk-taking in improving the teaching of multihandicapped children, and in the blending of at least two psychological models for the education of deaf-blind children described by Dr. Ashurst and Mrs. Bisno.

The detailing of the great number of ideas and principles brought out by the presenters, and you the participants, is beyond the scope of this synthesis. The data relative to your needs you will carry away with you in your head, on paper, or on audio tape. The material that comprises the content and scope of this symposium will appear in the proceedings. Should any of you desire a detailed break-out of principles and ideas assembled by your synthesizer, I will be glad to send them along to you if you will supply a stamped, self-addressed envelope and the top off the cereal box from the breakfast table this morning.

In closing, I would like to be presumptuous enough to suggest questions and problems that require our attention. These include:

1. A consideration of the characteristics of instructional settings that model the environment and maximize the opportunity for the visually and auditorially deficient child to learn to operate efficiently.
2. A consideration of the need for a national effort to write a standards and nomenclature manual similar to that prepared by the American Association on Mental Deficiency in 1965.
3. An analysis and description of the character of a comprehensive quality control system for program management -- a system that encompasses program operations at local levels.
4. A definition of the competencies that are requisite for operators working with children exhibiting sensory defects, and
5. _____ I leave this fifth problem open and ask you to describe the problem that you feel is paramount for workers in the field. Will you help establish direction by writing your statement on the card provided and returning it at the close of the session?

In closing, I would like to extend appreciation to Mr. Robert Dantona and the regional directors of the deaf-blind centers for having assembled such a stimulating and dynamic group of workers to consider the problems of the auditorially and visually handicapped child. Our thanks go especially to Dr. Blea and his staff for the planning and development of this National Symposium on the Deaf-Blind.

PROGRAMS AND SERVICES FOR THE DEAF-BLIND: PROBLEMS AND QUESTIONS

CLUSTER I

1. The most crucial needs facing us today are the establishment of valid program evaluation, the relaxation of professional "isms," and true interdisciplinary sharing of one's "holy sacrament."
2. More specific outline and measurement of effective treatment procedures (teacher-therapist-psychological) so we can begin to more stringently evaluate programs.
3. How do we assure that initial assessment is followed and information from instruction fed back and evaluated?

CLUSTER II

1. Making information derived from assessment/evaluation programs and research meaningful and useful to those individuals directly responsible for the children's educational development programs.
2. An ordered, national data collection base for D-B to include a clearing-house specifically for research, training information, and materials related specifically to this population.
3. Of the ten conference speakers, seven stated that they have little direct experience in dealing with deaf-blind children, yet the audience was composed primarily of people who are working with deaf-blind children. Things are happening. Why cannot we have speakers who are knowledgeable in the field? Why cannot funds be found to insure the writing of research which is currently being conducted in the field?
4. There is a need for bringing these concerns and reports to a variety of people in the educational system: teachers, administrators, legislators, parents, and taxpayers.
5. I feel that a center should be set up that will work very much similar to T.A.D. to allow anyone setting up a program to find people, places, and things that are available. It is very disturbing to have to come so many miles to find out about new publications, techniques, and ideas that were looked for at a time of prime need.
6. Most concerned to see wider dissemination of information already available to a few specialists about brain function and its implications for interpreting pathological behavior in multihandicapped.
7. There is a plethora of information dispersed across the country relevant to providing diagnostic and habilitative services for the M.H. child. Much is convergent, much is divergent. Areas not specifically focusing upon the M.H. child (e.g., residential facilities for MR), are typically not equipped with the information, funding, or service delivery resources for the M.H. How do we go about--and who do we go to--for the assistance necessary to establish and refine programs? If, as Don described in his summary, time is of the essence for the child, what coordination is possible to prevent wastage of time and effort?
8. The establishment of communication networks on programs for multihandicapped children so that we are regularly apprized of what is "happening" in other places.

CLUSTER III

1. A problem of utmost importance to me is a lack of awareness and interest in the communities to which our children must be integrated. These people must be educated to accept our children.
2. The development of correct attitudes among professionals, parents, administrators, legislators, which would allow and provide for programs of treatment and services which could use all the hardware and software that is available.

CLUSTER IV

1. Lack of communication in the field.
2. The chief problem which we have identified has been the procedural one of communications--inter--and to some extent, intradepartmental. Over and over again, the phrase or term "communications gap" recurs. I have no good solution to propose, but I strongly feel that personal contact should supplement the memo and leaseline routes which have often contributed to misunderstandings.
3. The gap between the medical disciplines is amazingly wide. Greater communication should be developed rather than have them go their independent ways.
4. The biggest single need at the present time is the need for inter-disciplinary training and sensitivity. The kids are rendered a disservice by our failure to understand each other.
5. To develop definitions -- parameters of "point-to-able" limitations which provide for operations for intervention and communication across and among the professionals and parents.
6. Do we need to refer to these children by a name other than deaf-blind?

CLUSTER V

1. Long-range planning for future educational, vocational, and residential needs of D-B population. Also, consideration of broadening the activities of the D-B Centers to include other multihandicapped children, particularly at the preschool level.
2. Many programs are good ones -- are on-going for the deaf-blind child. We need plans and designed opportunities for the Older Elementary School deaf-blind.
3. Adequate programming. Further research on educational planning.
4. The establishment of an experimental school whereby longitudinal research could be conducted over a number of years to explore the various ideas which were expressed as possibly being productive of accelerating progress with the deaf-blind in adaptation, etc., as well as contributing to a better understanding of processes (neurological and psychological).
5. Application of theory or research that has been common knowledge for 20 years at the 0-5 years period. What kind of long-range planning can we do for these children considering what may be a tenuous financial situation?
6. One of the future problems will be how to continue to deliver quality service to a population whose incidence is diminishing.

CLUSTER VI

1. It appears that there now needs to be a list of programs or competencies needed by workers of deaf-blind children. The children and their problems are too complicated to leave this to chance.
2. Problem: Need for improved preparation of those with major instructional responsibility for deaf-blind.
3. How do we begin to submit teaching concepts to meet research needs and standards? Blend education with research and development?
4. I feel that we need more information and help in the development of the lower functioning deaf-blind child. A conference involving people who have successfully worked with these children to pass on their methods would be valuable. A standardized manual system would also help.

CLUSTER VII

1. How can we do a better job of helping the child to interpret and use the sensory input that does get through to him?
2. I'd be interested in knowing more about actual brain function and dysfunction and controlled experimental studies in _____
3. The development of programmed curriculum materials, especially in the area of language development.
4. A further amplification and discussion on techniques and therapy as brought out in Dr. Ayres' findings.
5. Language learning -- conditioning it "in" experientially or what other or many approaches. Are D-B using one system (visual for ex.) more efficiently than another?
6. There is a great need for coordination of services in the area of parent counseling.

Future meetings should extend themselves to psychologists, speech and language specialists, and medical personnel in the field who need assistance and guidance in working with deaf-blind.

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